Final Remediation Plan

Santa Fe Judicial Complex

Santa Fe, New Mexico

Facility ID No. 47997, Release ID No. 3604

Volume 2: Appendices C Through I

Prepared for **New Mexico Environment Department**
Petroleum Storage Tank Bureau

February 16, 2010

Daniel B. Stephens & Associates, Inc.

6020 Academy NE, Suite 100 • Albuquerque, New Mexico 87109

Final Remediation Plan
Santa Fe Judicial Complex, Santa Fe, New Mexico
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Appendix

C Product Cut Sheets

D Technical Specifications

E Permits

F Operation and Maintenance Data Collection

G Health and Safety Plan

H Legal Notice Publication

I Schedule for Implementation of Final Remediation Plan

Appendix C

Product Cut Sheets

Intellishare Environmental, Inc.

Thermal Accelerator

About Our Thermal Accelerator

The perfect oxidizer for free product sites, when maximum hydrocarbon burning capabilities and expedited remediation are required. The Thermal Accelerator will burn more hydrocarbon vapor per hour than a thermal oxidizer or internal combustion engine and at a fraction of the operating cost. Available with catalyst and heat recovery modules for maximum flexibility.

Intellishare Environmental specializes in the engineering and manufacturing of oxidation technology for soil and groundwater remediation, VOCs , HAPs and odor abatement.

Description

The Thermal Accelerator is a hybrid enclosed thermal flare designed to treat high concentration levels of VOCs without the need to dilute the concentrations prior to combustion.

The Thermal Accelerator uses a specially built dual fuel burner, which allows the injection of the high concentration process directly into the burner.

By injecting the fume stream directly into the burner it operates similar to flare technology. Since the fume stream is not injected into a combustion chamber directly the thermal accelerator is not subject to NFPA 86 maximum 50% LEL requirements for ovens, furnaces and oxidizers and processes high concentration fume streams safely.

The process air is then mixed with supplemental fuel (natural gas or propane) and combustion air at the burner to create a stable flame front.

Additional ambient cooling/tertiary air is added to the combustion chamber to maintain the desired combustion temperature up to 1800° F.

Options

Catalyst: Metal Monolith for <20% LEL

Electrical Rating: Class 1 Division 1/2, Group D

Safety Rating: SIL—Safety Integrity Level

Remote Telemetry: SCADA

Air Flow: Sensor or transmitter with 4-20 mA output

Recording: Up to four 4-20mA input, paper or paperless

Process Blower: Centrifugal Fan

SVE Blower: Multiple SVE blowers or vacuums

Additional Sizes: 250-1000 SCFM

System Specification

Model:	TA-500
Air Flow: Treated	100-500 SCFM
Pressure Drop:	Maximum 30" WC
Concentrations:	>250 lbs/hr
Input Voltage:	208-230V/460V/3Ph/50-60Hz
Overall Size:	26' L, 8'6"' W, 9' H
Overall Weight:	12000 lb
Base:	A-36 Carbon Steel
Reactor:	A-36 Carbon Steel—Painted
Inlet & Outlet:	Flanged
Lifting:	Forklift or Crane
Insulation:	8" High Temp Ceramic Fiber
Stack:	304 Stainless Steel
Catalyst:	Catalyst Ready
Detonation Arrestor:	Spiral crimped element
Burner Type:	Dual Fuel/Primary Air
Pilot Type:	Interruptible
Burner Capacity:	8 mmBtu/h
Fuel Requirement:	1.8 mmBtu/h
Main Control Panel:	Nema 4
Disconnect:	600 VAC
Control Type:	Allen Bradley PLC
Operator Interface:	Allen Bradley Touch Screen
Exotherm Control:	Tertiary/Temperature/VFD
Temp Range:	1400-1800° F
Max Temp:	1800° F
Thermocouples:	Type K C1, D1, GD
Temp Control:	PID with gas control valve
Temp Sensor:	Type K Thermocouple

INTELLISHARE ENVIRONMENTAL
CLEAN AIR SOLUTIONS

Special Points of Interest:

- Safely processes high LEL fume streams
- Uses process fumes as fuel to reduce energy use and operating cost
- Accelerates site clean up time by processing more vapor than conventional thermal oxidizers and IC engines
- All combustion is internal to the oxidation chamber

Other Products & Services:

Electric Catalytic Oxi-

Gas Fired Catalytic

Electric Thermal Oxidizer

Gas Fired Thermal Oxidizer

Chlorinated/

Regenerative Thermal

Complete Soil Remediation Oxidizer Pack-

Used and Rentals

Field Repairs

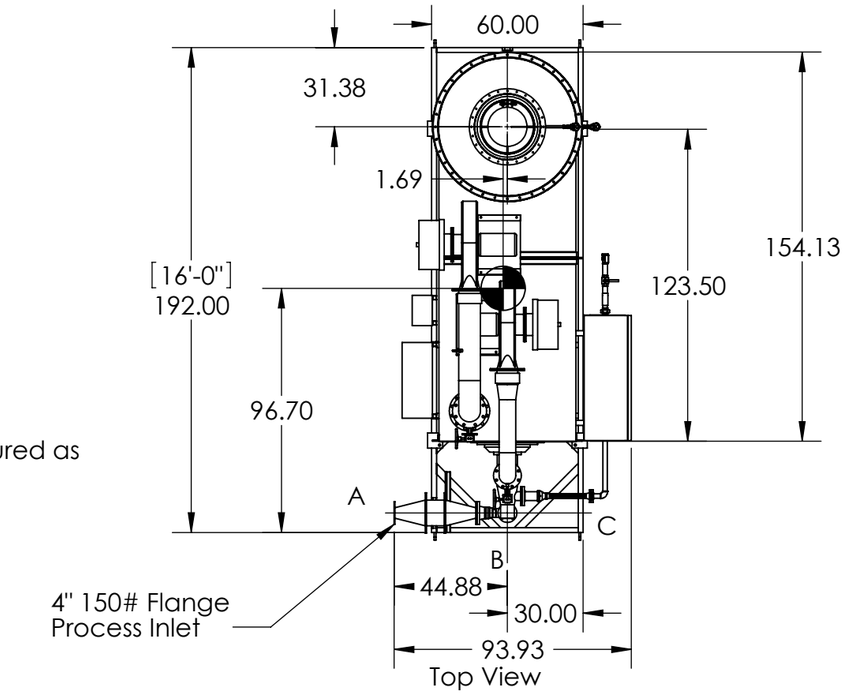
Training

Emergency Response

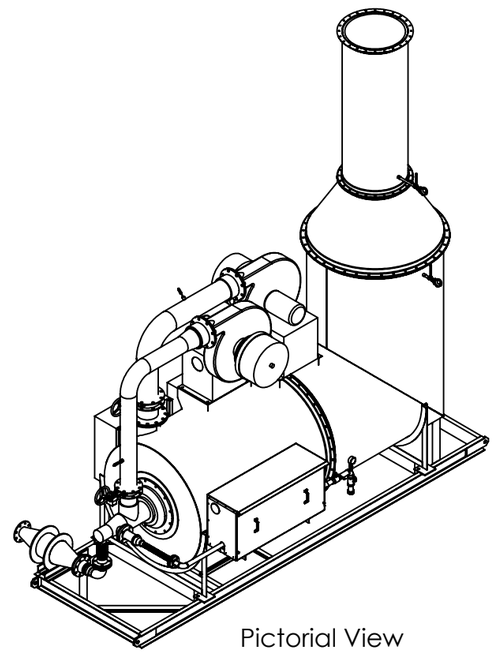
= Center of Gravity

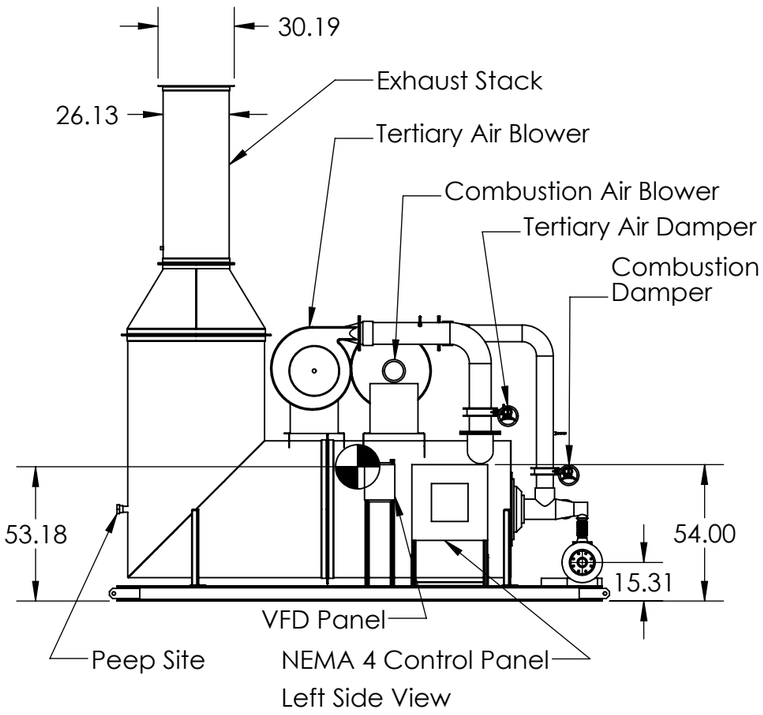
Note:
Process Inlet may be configured as optional positions A, B, or C.

Position A is default.

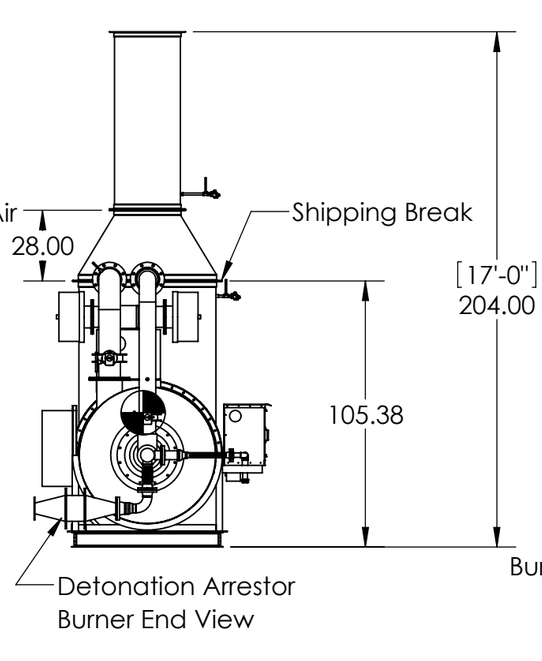


Top View

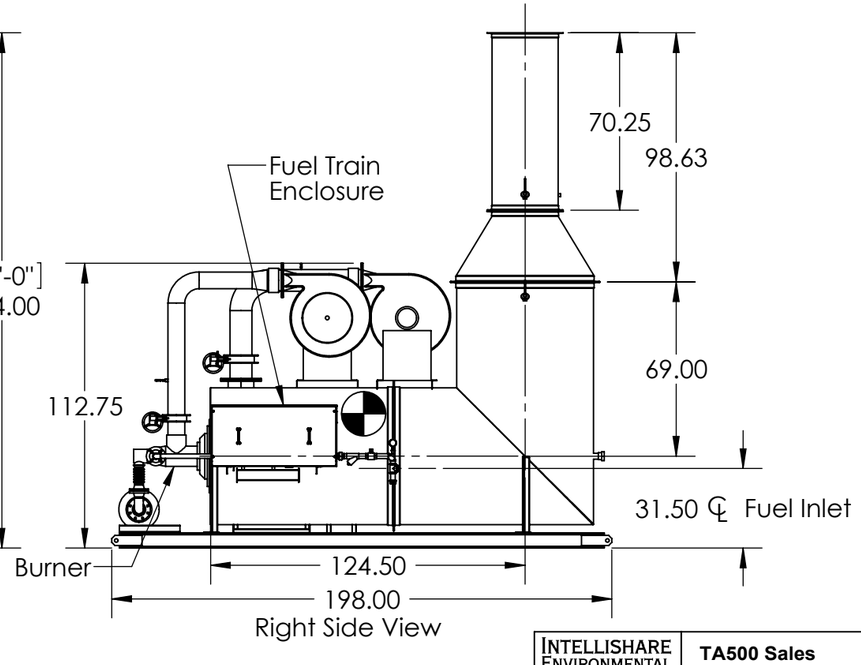

Pictorial View



Left Side View



Burner End View



Right Side View

Estimated Unit Weight: 7500 lbs

INTELLISHARE ENVIRONMENTAL
CLEAN AIR SOLUTIONS

TA500 Sales

TITLE	TA500 Thermal Accelerator Sales Drawing
DRAWING NO.	TA500 Sales
SCALE	NTS
DRAWN	Henry A 8/20/2008
CHECKED	
APPROVED	
Contact:	Intellishare Environmental, Inc. E4803 395th Ave. - Menomonie, WI 54751 www.intellishare-env.com Phone: 715-233-6115 FAX: 715-233-0669
REV.	A
LAST DRAWN BY	Henry A 5/29/2009
SOURCE	
PAGE	1 OF 1
LAST PLOTTED BY	XXX DATE XXX
FILE PATH	

Intellishare Environmental, Inc.

Gas Fired Thermal Oxidizer

About Our Gas Fired Thermal Oxidizer

The Intellishare thermal oxidizer was developed on a modular platform allowing for maximum flexibility in system selection. Each system can be configured multiple ways to fit nearly any space requirement. All units are designed to incorporate our heat recovery and catalyst modules and are built for long term reliability and performance.

Intellishare Environmental specializes in the engineering and manufacturing of oxidation technology for soil and groundwater remediation, VOCs , HAPs and odor abatement.

Features & Benefits

Modular Construction: We can help you spend your project dollars wisely! Our units are built to allow catalyst modules, heat exchangers and LEL monitors to be easily field inserted at any time.

High Temperature Combustion Chamber: Low outer skin temperature and greater than 99% destruction efficiency.

Intellishare One Touch Controls: Reduces operator error and increases uptime by taking the guesswork out of operation. Walks the operator through basic system tasks such as start-up, shut-down and trouble-shooting.

PLC: PLC offers unlimited programming flexibility without control panel modification.

Honeywell Flame Control: Provides exceptional reliability in display of burner system status and flame strength.

Automatic Dilution Control: Reduces operator site time by automatically adjusting to varying hydrocarbon concentrations preventing temperature overshoots and system shut-downs.

UL Listed Controls: Certified UL compliant.

Options

Catalyst: Metal monolith

Electrical Rating: Class 1 Division 1/2, Group D

Safety Rating: SIL—Safety Integrity Level

LEL Monitor: Catalytic or IR type with 4-20 mA output

Air Flow: Sensor or transmitter with 4-20 mA output

Recording: Up to four 4-20 mA input, paper or paperless

Process Blower: Centrifugal Fan

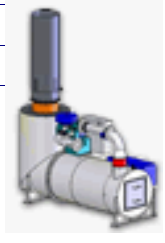
SVE Blower: Multiple SVE blowers or vacuums

Additional Sizes: 250-3000 SCFM

System Specification

Model:	500 CFM
Air Flow:	200-500 SCFM
Pressure Drop:	Maximum 12" WC
Concentrations:	0-50% LEL
Input Voltage:	230V/1Ph/60Hz or 208-230V/460V/3Ph/50-60Hz
Overall Size:	12' L, 6' W, 8' H
Overall Weight:	4000 lb
Reactor:	A-36 Carbon Steel
Heat Exchanger:	300 Series Stainless Steel
Main Control Panel:	Nema 4
Disconnect:	600 VAC
Control Type:	Allen Bradley PLC
Operator Interface:	Allen Bradley Touch Screen
Flame Arrestor:	Spiral crimped element
Stack:	300 Series Stainless Steel
Insulation:	8"-8lb density soft ceramic
Exterior:	Painted
Base:	A-36 Carbon Steel
Optional Catalyst:	400 CPSI Precious Metal Monolith
Inlet & Outlet:	Flanged
Lifting:	Forklift or Crane
Purge/Dilution:	Automatic
Gas Pre-Heater:	1.5 MMBTUH
Temp Range:	1400-1600° F
Max Temp:	1800° F
Thermocouples:	Type J C1, D1, GD
Temp Control:	Honeywell
Optional Heat Exch	Nominal 50%

Visit us on the web to view a 3-D animation!



INTELLISHARE ENVIRONMENTAL
CLEAN AIR SOLUTIONS

Special Points of Interest:

- Multi mode operation
- Primary or secondary air burners
- Highest uptime percentage of any oxidizer
- Horizontal or vertical orientation

Other Products & Services:

Electric Catalytic Oxidizer

Gas Fired Catalytic Oxidizer

Electric Thermal Oxidizer

Thermal Accelerator

Chlorinated/ Fluorinated Oxidizer

Regenerative Thermal Oxidizer

Complete Soil Remediation Oxidizer Packages

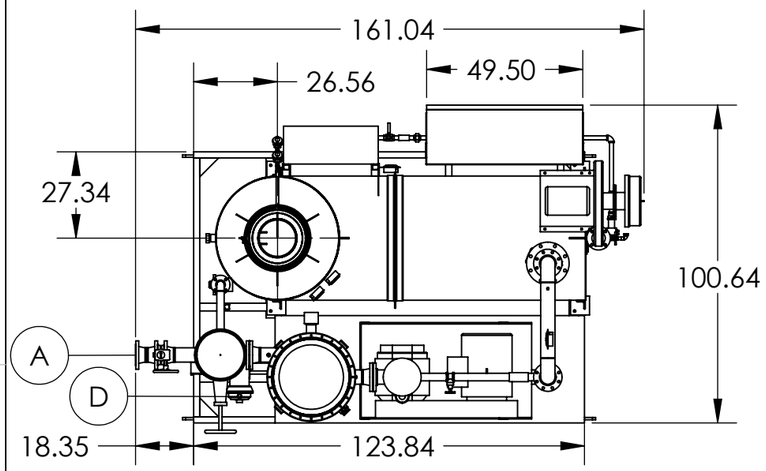
Used and Rentals Available

Field Repairs

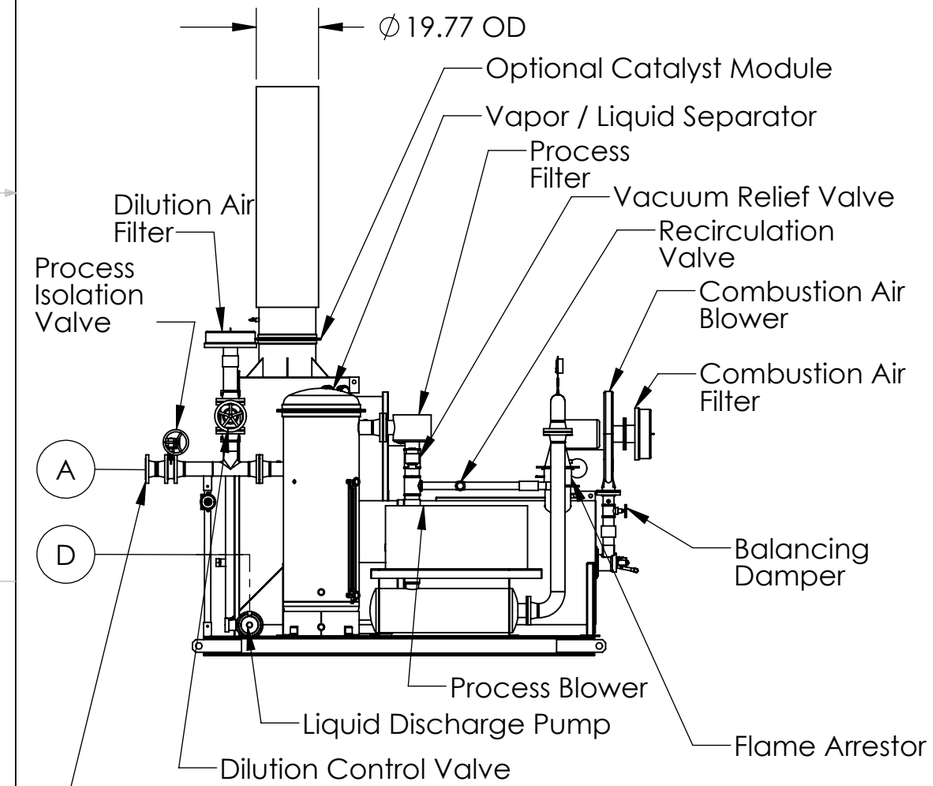
Training

Emergency Response

CONNECTION SCHEDULE		
MK	SIZE	DESCRIPTION
A	6" 150#	INLET FROM VAPOR WELLS
B	1" FNPT	INLET NATURAL GAS
C	1" FNPT	DISCHARGE TO WASTE WATER TREATMENT

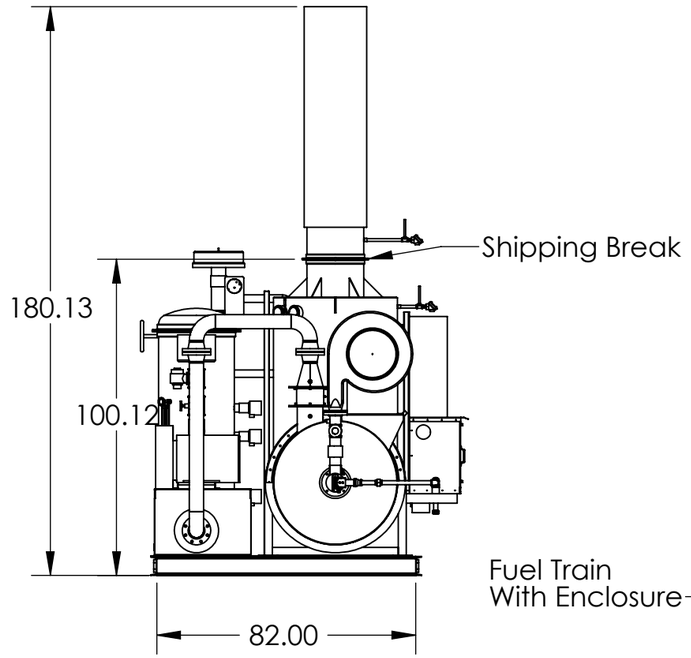


Top View

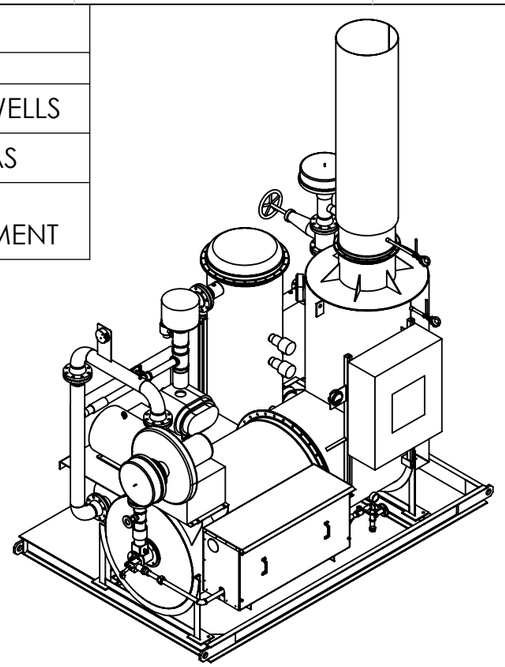


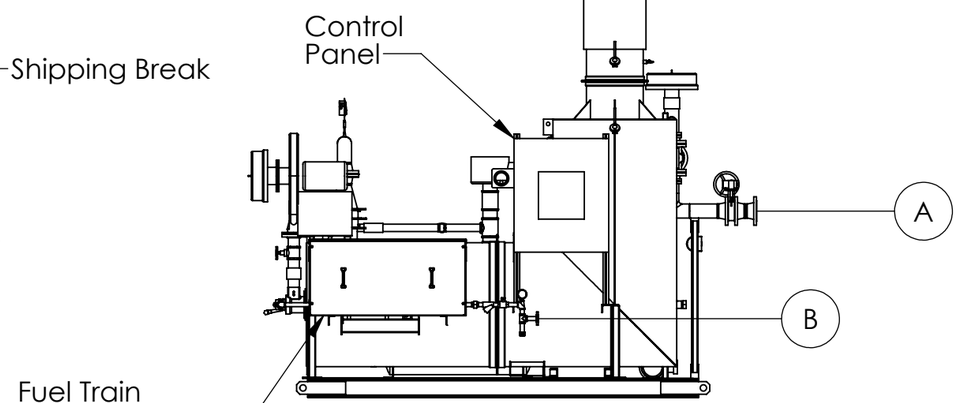
Left Side View

Approximate Weight: 7500 lbs



Front View





Right Side View

Note: Dimensions given in Inches unless otherwise indicated.

INTELLISHARE ENVIRONMENTAL
CLEAN AIR SOLUTIONS

TO500 w-RPDSVE Sales Drawing

TITLE	TO500 W/RPDSVE SALES DRAWING
DRAWING NO.	TO500 w-RPDSVE Sales Drawing
SCALE	NTS
DRAWN	Henry A 8/2/2006
CHECKED	
APPROVED	
CONTACT:	Intellishare Environmental, Inc. E4803 395th Ave. - Menomonie, WI 54751 www.intellishare-env.com Phone: 715-233-6115 Fax: 715-232-0669
REV.	A
LAST DRAWN BY	Henry A 6/30/2008
SOURCE	
PAGE	1 OF 1
LAST PLOTTED BY	XXX DATE XXX

Operation & Maintenance Guide

INTELLISHARE ENVIRONMENTAL

CLEAN AIR SOLUTIONS

Client:
DB Stephens & Associates Inc.

Project:
Santa Fe

Equipment:
500 CFM Thermal Oxidizer
Unit Number N-10-XXXX

E4803 395th Avenue ◊ Menomonie, WI 54751 ◊ Phone: 715.233.6115 ◊ Fax: 715.232.0669 ◊ www.intellishare-env.com

INTRODUCTION

Purpose

Intellishare Environmental, Inc.' s 500 CFM Thermal Oxidizer with Catalyst Module destroys organic vapor contaminants which are discharged from soil vapor extraction, ground water treatment systems, or other systems during site remediation.

Precautions

Lower Explosive Limit (LEL)

It is important to understand the meaning of the term Lower Explosive Limit (LEL), sometimes also referred to as Lower Flammability Limit (LFL).

Lower Explosive Limit: Gases or vapors which form flammable mixtures with air or oxygen have a minimum concentration of vapor in air or oxygen below which propagation of flame does not occur on contact with a source of ignition (LEL).

There is also a maximum proportion of vapor or gas in air above which propagation of flame does not occur (UFL). These boundary line mixtures of vapor or gas with air, which if ignited will just propagate flame, are known as the "lower and upper flammable or explosive limits", and are usually expressed in terms of percentage by volume of gas or vapor in air.

The LEL is based upon normal atmospheric temperatures and pressures and the general effect of increase of temperature or pressure is to decrease the lower limit and increase the upper limit.

Applicable codes require thermal solvent processing systems to operate no higher than 25% LEL without an LEL monitor and control. Insurance companies may require LEL systems if an oxidation system is added to existing machinery.

For further information concerning the maintenance of safe LEL levels, the operator should refer to NFPA Bulletin 86A and FM Loss Prevention Bulletin No. 14.15. These bulletins will delineate how safety interlocks can be implemented in the operator's system.

!! DANGER!

Never operate the catalytic or thermal oxidizer at a concentration of vapors greater than 25% of the LEL. Even low concentrations of extremely volatile vapors may cause an explosion within the reactor system with the possibility of serious personal injury and property damage.

!! DANGER!

It is the operator's responsibility to make certain that the concentration of vapors entering the catalytic or thermal oxidizer remains less than 25% of the LEL of the vapors.

Site Considerations

1. Sites being remediated may contain equipment using relatively large quantities of gas, oil, steam, and/or electricity. Any high energy equipment carries with it a potential danger to personnel and property, and must be treated accordingly.

2. All equipment must be installed and operated in accordance with OSHA regulations, all applicable electrical, plumbing, steam boiler and building codes, necessary permits secured, and meet the requirements of your insurance carrier. Unless specified in our proposal, these are areas of customer responsibility.

3. The area should be maintained free from any hazards that would prevent easy movement around the catalytic reactor and electrical control cabinet. No flammable or otherwise hazardous materials should be stored in the immediate vicinity of the catalytic reactor. No work materials, papers or other materials should be placed on the catalytic reactor.

4. Review the operation of the oxidizer with your site safety officer before starting the unit. Any suggestions and additions should be included with these instructions.

   All those involved in the operation of the system should read and understand the complete operating instructions before starting the unit. Safety meetings of all those involved with the system should be held periodically in conjunction with implementing acceptable maintenance procedures.

5. Any change in process load, temperature, ventilation or other modification should be checked with Intellishare Environmental, Inc. in advance to determine equipment capabilities.

6. Determination of catalyst or thermal efficiency in hydrocarbon oxidation is made by gas analysis of samples drawn from the system prior to and immediately after the catalyst exit face or in a thermal oxidizer system prior to and immediately after the combustion chamber. A gas analysis should be performed in the event the operator suspects any loss of catalytic activity via visual inspection or by observing that the temperature rise across the catalyst has been reduced. Before attempting any corrective measures, contact Intellishare Environmental, Inc. We will assist in determining corrective action, and if applicable, will provide specific instructions.

7. It is our desire to provide the operator with the safest and most productive equipment possible. Revised national safety standards and technological improvements will require the user to periodically review this equipment, and may require upgrading for compliance.

Process Definition

Volatile Organic Compounds (VOCs)

Volatile Organic Compounds (VOCs) are hydrocarbons which, in a gaseous or vapor form, regulatory agencies have determined contribute to air pollution. Specifically, these are hydrocarbon compounds which can enter the atmosphere (become volatile) and which chemically react with each other and other elements in the air as a result of exposure to sunlight. Such chemical reaction due to sunlight is called "photo-chemical activity". This photo-chemical activity results in what we commonly call "smog".

Catalytic Reaction

With reference to chemistry, a catalyst is a material which allows or causes a chemical reaction to take place under certain conditions which would not ordinarily occur given those conditions. For example, given a compound such as gasoline, mixed with sufficient oxygen for burning, if it was desired to ignite the mixture by simply raising the air temperature (as opposed to ignition by exposure to a flame or spark), the air temperature would have to be raised to over 1,000°F.

However, in the presence of the proper catalyst, the gasoline would combust (oxidize) with the air temperature at only 500°F. Thus, the catalyst causes the reaction to occur, even though the temperature is such that the burning could not possibly take place without the presence of the catalyst.
A unique property of the catalyst is that it is not consumed in the reaction. When a hydrocarbon burns, it is converted to carbon dioxide and water.

Thermal Oxidizer Mode

During thermal operation, VOC-laden air is drawn into the oxidizer's blower and is discharged into the system's combustion chamber. Finally, the treated air is exhausted into the atmosphere.

Catalyst Mode

When the VOC-laden air passes through the catalyst, an exothermic (heat producing) reaction takes place. The VOCs in the air stream are converted to carbon dioxide and water vapor and the air temperature is raised by the process.

SYSTEM SPECIFICATION

Manufacturing Information

Manufacturer:	Intellishare Environmental, Inc.
Model:	TO500
Type:	Thermal Oxidizer
Serial Number:	N-10-XXXX
Date of Manufacture:	February 2010

Operating Specification

All values established for required VOC destruction efficiency

Maximum VOC Content:	40% LEL Using LEL Monitor
VOC Destruction Efficiency:	99%
Maximum Process Air Stream:	500 SCFM
Temperature Control Method:	Firing rate of burner controlled via temperature PID loop controller
Thermal Up to Temperature:	1350˚ F
Thermal Operating Temperature:	1400˚ F
Thermal Mode High Limit Safety:	1600˚ F
Thermal Exit Dilution Control:	1450˚ F
Catalyst Ready Temperature:	550˚ F
Catalyst Inlet Temperature Control:	600˚ F
Catalyst Inlet High Temperature Safety:	900˚ F
Catalyst Exit Dilution Control:	950˚ F
Catalyst Temperature High Limit Safety:	1200˚ F
Combustion Air Flow Pressure:	0.4” w.c.
System Air Flow Pressure:	0.4” w.c.
Catalyst Differential Pressure:	12” w.c.

Mechanical Specification

Inner Wetted Material:	High Temperature Refractory
Outer Skin Material:	Carbon Steel
Outer Skin Thickness:	7 Gauge
Temperature Sensors:	K-Type Thermocouples

Burner and Associated Equipment

Manufacturer:	Eclipse
Model:	Therm Jet
Type:	Primary Air Burner
Maximum Fire Rating:	1,500,000 BTU/HR
Voltage Input:	460/3/60

Instruments

Inlet Temperature Control:	Honeywell
Outlet Temperature Control:	Honeywell
High Temperature Limit:	Watlow
Chart Recorder:	N/A

Master Bill of Material

Qty	P/N	Title	Cut Sheet
		BURNER	
2	I1-02-2046	BOOT, PROTECTOR	N/A
1	TJ26.0150-A1AAMATNC6NE6X0	BURNER, THERM JET 150	Eclipse TJ 150, Eclipse TJ Install
1	120054	PEEPSIGHT, 2/3 PIPE UNION, 2" NPT	N/A
1	I1-RSN	TERMINAL, RING	N/A
1	I1-SSN	TERMINAL, SPRING SNAP	N/A
1	AO6SA6X	TRANSFORMER, IGNITION	Dongan AO6-SA6X
		FAN/FAN ASSEMBLY	
1	NYB-1703 CW DB 3HP 3PH	BLOWER, PRESSURE, NYB 1703, CW, DB, 2HP, 3600 RPM, 145T, 3-60-230/460	NYB PB, NYB PB IM
1	3105	VALVE, 3" BRONZE GATE, MILWAUKEE	Milw Gate 105
1	NYB-1606 CCW TH 3HP 3PH	BLOWER, PRESSURE, NYB #1606A, 3 HP TEFC, 208-230/460VAC, 3PH, 182T, ARR-4, ALUM WHEEL, CCW THD, DRAIN W/PLUG, W/TEFLON SHAFT SEAL	NYB PB, NYB PB IM
1	6BWM-1153-N	VALVE, BUTTERFLY 6" NPT	Valv-tech
1	F72-6	FILTER SILECER, AIR INTAKE 6"	Stoddard F72 Series
1	F72-5FLG	FILTER SILENCER, AIR INTAKE 5"	Stoddard F72 Series
1	5285K122	MARINE FLEX HOSE 3-1/2" ID (Combustion Air)	Federal 5155 Hose
1	5296K89	MARINE FLEX HOSE 6" I.D. 25 PSI MAX	Federal 5155 Hose
1	3WESCF	FLANGE, 3", THREADED NPT, RF, 150#	N/A
1	318FLGA	GASKET, FLANGE, FF, 3" X .125" THICK, 150#	N/A
1	518FLGA	GASKET, FLANGE, FF, 5" X .125 THICK, 150#	N/A
4	618 FLGA	GASKET, FLANGE, FF, 6" X .125 THICK, 150#	N/A
1	818 FLGA	GASKET, FLANGE, FF, 8" X .125 THICK, 150#	N/A
		CONTROLS	
1	C7027A 1064	SCANNER, UV W/24' LEAD WIRE	HW C7027A UV Scanner
1	CVR83A-600R	WEATHER KIT	JC Weather Cvr Kit CVR83A-600R
2	KKK48U-022-00-8HN34	THERMOCOUPLE, TRIPLE TYPE K	Pyromation T-02 & T-02 Tech
1	M130GGA-3	ACTUATOR, 24V	JC Actuator M100 1 & 2
1	S91DJ-1	SWITCH, AUXILIARY, 1 SPDT	JC Aux Switch S91DJ and S91EJ
1	Y20DAA-KIT-2	LINKAGE ASSEMBLY, VALLEY	N/A
3	S0274M4BST	VALVE, SAMPLE PORT	N/A
		FLAME ARRESTOR	
1	80019931	ARRESTOR, FLAME ELEMENT BANK 4"	Groth FA IOM, Groth FA 7618-7628
2	IEC-000-0103-3	GASKET, RING, FOR 4" FLAME ARRESTOR BROWN DIE # 62	N/A
		CONTROL PANEL	
1	RM7895B 1013	PRIMARY RELAY	HW Primary Relay 7800 1, 2 & 3
1	Q7800A 1005	WIRING SUBBASE	HW Wiring Subbase
1	ST7800A 1039	PURGE TIMER, 30 SECONDS	HW Purge Timer 7800 Series

Master Bill of Materials (Continued)

Qty	P/N	Title	Cut Sheet:
1	R7849A 1023	AMPLIFIER, UV FLAME, 2 OR 3 SEC	HW Amplifier 7800 Series
2	DC2500-CE-1A00-200-00000-00-0	CONTROLLER, TEMPERATURE	HW UDC 2500.pdf
1	LVC6KW10002000A	CONTROLLER, HI-LIMIT AUTO RESET, 120VAC, SCREW TERMINALS	Watlow Series L Temp Controller
		FUEL TRAIN	
2	JV-100-703	VALVE, BALL, 1/2" NPT	N/A
1	M1-325-3-1/2	REGULATOR, 1/2", NO LIMITER	Maxitrol MI2010, MI2011
2	A2-8214G20	VALVE, SOLENOID, ASCO, 1/2"	ASCO 8214
1	M1-RV48	REGULATOR, 1/2",W/O VENT RELIEF,3-6"	Maxitrol MI2010, MI2011
1	J7840P	GAUGE, BOURDON TUBE, MARSH 0-15 PSIG, ¼ " NPT, LIQUID FILLED	Marsh 63mm SevServ Gauge
1	ST-11M-1	Y-STRAINER, 1" NPT	N/A
1	501231	VALVE, BUTTERFLY, AUTOMATIC, REDUCED PORT, 1" NPT	Eclipse BV
2	JV-100-705	VALVE, BALL, 1" NPT	N/A
1	JV-210-996-C	LOCKING DEVICE, CLODE ONLY 1" - 1-1/4"	N/A
1	D229846	SPRING #5, RED, 10 TO 22" WC	N/A
1	VA-3018	GAS COCK, 1/2", ADJUSTABLE	N/A
1	D217338	SWITCH, LOW GAS PRESSURE GML-A2-4-4, 1-20" WC	Dungs Gas Pressure Switch GAO, GMH, GML A2.pdf
1	D214975	ADAPTOR, FOR SIDE MT HIGH GAS SW ON DMV	N/A
2	D219008	TEST NIPPLE	N/A
1	D217324	SWITCH, PRESSURE GMH-A2-4-6, 12-60" WC	Dungs GAO GMH GML A2
2	D225047	ADAPTER ACCESSORIES, 1/4" NPT	N/A
2	D230474	PRESSURE REGULATORS, FRI 710/6	Dungs Pressure Reg FRI 705-12
1	46000-6	VISUAL INDICATOR FOR DMV	N/A
1	D230791	DMV-D 702/622 DUAL MODULAR VALVE, 1-2" BODY SIZE, FAST OPEN/CLOSE, ADJ MAX FLOW	Dungs DMVD Multivalve
1	D229847	SPRING #6, YELLOW, 12 TO 28" WC	N/A
2	D222369	FLANGE 1" NPT, DMV 702/703	N/A
1	25-1490-A-02L-XTUZY-0-30WC	GAUGE, LOW PRESSURE DIAPHRAGM, 0-30" WC, ¼" NPT	Ashcroft Pressure Gauge 1490
1	M130GGA-3	ACTUATOR, JOHNSON CONTROL 24V, 4-20 mA INPUT	JC Actuator M100 1 & 2
1	S91DJ-1	SWITCH, SWITCH, AUXILIARY, 1 SPDT FOR JC ACTUAT	JC Aux Switch S91DJ
1	100099	KIT, ACTUATOR MOUNTING, 0.5-4", V2	N/A
2	46020-3	SWITCH AIR PRESSURE, .4-4" WC	Dungs Air Pressure AA A2
1	46020-5	SWITCH, AIR PRESSURE, 2-20" WC	Dungs Air Pressure AA A2

Component Data

Please refer to accompanying CD for component specification information.

MAINTENANCE & SAFETY

System Maintenance

Though relatively trouble-free in operation, the oxidizer is primarily a piece of combustion equipment with consequent mechanical rotating equipment in the form of fans and motors, temperature and fuel controls with safety interlocks, an electrical control system, loop controls to maintain temperature and flow rate parameters for maximum efficiency, and other components. Many elements of the oxidizer design are included in compliance with Factory Mutual (FM), Industrial Risk Insurers (IRI), and National Fire Protection Association (NFPA) requirements.

As such, like any piece of combustion equipment, the oxidizer must be regularly maintained and should be fully inspected and evaluated at least annually.

A checklist of maintenance items and recommendations is included as a separate entry in this manual. The maintenance items should be reviewed and carried out on an as needed basis and at least once per year.

Regular maintenance not only assures compliance with the appropriate clean air regulatory agency requirements, and the requirements of safety regulatory bodies and insurance carriers; it also helps maintain equipment efficiency for minimum operating costs.

Preventive Maintenance Evaluation Program

As an aid to maintaining oxidizer operation at peak efficiency, Intellishare Environmental, Inc. offers a Preventive Maintenance Evaluation which includes a complete inspection and evaluation of oxidizer components and performance along with tuning and adjustment, as needed.

It is recommended that the Preventive Maintenance Evaluation be performed at least once per year.

A check list and evaluation summary is provided with each inspection. The summary identifies maintenance requirements and recommendations for corrective action if any is required.

The preventive maintenance evaluation is custom tailored to the particular piece of equipment inspected, but includes:

1. Mechanical
An external and internal inspection of the oxidizer and mechanical components is performed. This includes fan and motor assemblies, burner (or heater on electric units), catalyst, reactor chamber, stack and observation ports, access doors, ductwork, dampers, and linkages.

2. Electrical
Electrical components are visually inspected and electrically tested for proper function. This includes switches, lights, relays, timers, controllers, recorders, motors, motor starters, motor drives, damper and/or valve actuators, disconnects, wiring, alarm detection and annunciation, and logic circuits.

3. Process Control Loops
The temperature and pressure control loops are inspected and tested to verify correct operation of sensors, loop controllers, and end control devices. This includes tests of the electric heater\burner firing rate, fan variable speed drive or vortex damper reaction, actuator performance, and loop tuning adjustment as needed.

1. Catalyst Evaluation and Oxidation Efficiency Test
An oxidation efficiency test is performed using a portable detector unit. Additionally, samples of the catalyst are sent for independent destruction efficiency evaluation. The catalyst evaluation and oxidation efficiency tests are valuable for detecting potential problems (should any exist) early, helping to avoid clean air compliance problems before they occur.

Preventive Maintenance Evaluation Initiation

For complete information on the Preventive Maintenance Evaluation Program contact the Technical Services Department of Intellishare Environmental, Inc.

Maintenance Checklist

Properly maintained equipment ensures maximum operating performance and minimum operating costs. Following is a schedule of suggested regular maintenance. Please refer to each individual manual for a more comprehensive maintenance list.

Main Components	Test	Monthly	Quarterly	Semi-Annually	Annually
Fan Mounting Bolts	Tightness	X			
Fan Motor Bearings	Lubrication	X			
Fan Motor Amperage	Windings	X			
Gas Train	Leaks	X			
Burner/Flame Visual	Quality	X			
Flame Strength	Signal	X			
Dilution Valve Linkage	Moves Freely	X			
Instrumentation	Condensate	X			
Temperature Controller	Accuracy				X
Electrical Wiring Terminals	Tightness			X	X
Flame Arrestor	Pressure Drop				X
Catalyst	Signs of plugging or discoloration				X
Chart Recorder (If paper type)	Change Paper	X			
Gas Booster (if equipped)	Belt Tension	X			
Gas Booster (if equipped)	Lubrication	X			
Gas Booster (if equipped)	Vibration	X			
Destruction Efficiency	Various				X
LEL Meter	Calibration		X		

Oxidizer Mode Change Instructions

!! DANGER!

Improper set-up could result in personal injury or permanent equipment damage. It is strongly recommended that Intellishare Environmental, Inc. be contracted to perform system mode changes. It is extremely critical that all temperature settings, inserts, damper positions, airflow and gas settings are correct.

Catalytic Mode to Thermal Mode

	Temperature Controllers
1.	Main power to the oxidizer control panel is required to be on for controller adjustment.
2.	Adjust the **High Limit Temperature Controller**. Open sub panel inner swing door on control cabinet. High Limit Temperature Controller is located on back panel of Control Cabinet. Press and hold set/reset button. Turn limit set point dial clockwise to read 1600 degree F. and then release the set/reset button. New limit set point is entered 3 seconds after the limit set point knob stops moving. Close Sub Panel Door.
3.	On the **Inlet Temperature Controller**, press set up button until CONTRL is displayed. Press the function button until SP Hi is displayed. Press the up arrow button until 1600 is displayed.
4.	Press set up button until ALARMS is displayed. Press the function button until A1S1VA is displayed. Press the up arrow button until 1600 is displayed.
5.	Press the set up button until ALARMS is displayed. Press the function button until A2S1VA appears. Use the up arrow display button until 1350 is displayed.
6.	Press the display button until SP appears in the lower display. Press the up arrow button until 1400 is displayed. Press display again and the inlet temperature control set points are complete.
7.	On the **Outlet Temperature Controller**, press the set up button until CONTRL is displayed. Press the function button until SP Hi appears. Press the up arrow button until 1600 is displayed.
8.	Press the display button until SP appears in the lower display. Use the up arrow display key until 1500 is displayed. Press display again and the outlet temperature control set points are complete.
9.	Press the Start button on the Operator Interface Panel to start the Oxidizer.
10.	Adjust LEL if equipped – Alarm Set Point should be at 40% LEL

	Catalyst Mechanical Removal
	Note: When reinstalling components, make sure flange gaskets are in good condition and proper position. Replace gaskets where necessary. Once the catalyst is removed note any unusual wear and/or discoloration.
1.	Cool Oxidizer to within 40 degrees of ambient temperature.
2.	Review and follow catalyst installation drawing and instructions.

Thermal Mode to Catalytic Mode

Temperature Controllers

1.	Main power to the oxidizer control panel is required to be on for controller adjustment.
2.	Adjust the **High Limit Temperature Controller**. Open sub panel inner swing door on control cabinet. High Limit Temperature Controller is located on back panel of Control Cabinet. Press and hold set/reset button. Turn limit set point dial counter clockwise to read 1100 degree F. and then release the set/reset button. New limit set point is entered 3 seconds after the limit set point knob stops moving. Close Sub Panel Door.
3.	On the **Inlet Temperature Controller**, press set up button until CONTRL is displayed. Press the function button until SP Hi is displayed. Press the down arrow button until 1000 is displayed.
4.	Press set up button until ALARMS is displayed. Press the function button until A1S1VA is displayed. Press the down arrow button until 900 is displayed.
5.	Press the set up button until ALARMS is displayed. Press the function button until A2S1VA appears. Press the down arrow button until 550 is displayed.
6.	Press the display button until SP appears in the lower display. Press the up arrow button until 600 is displayed. Press display again and the inlet temperature control settings are complete.
7.	On the **Outlet Temperature Controller**, press the set up button until CONTRL is displayed. Press the function button until SP Hi appears. Press the down arrow button until 1000 is displayed.
8.	Press the display button until SP appears in the lower display. Press the down arrow button until 900 is displayed. Press display again and the outlet temperature control set points are complete.
9.	Press the Start button on the Operator Interface Panel to start the Oxidizer.
10.	Adjust LEL if equipped – Alarm Set Point should be at 20% LEL.

Catalyst Mechanical Installation

	Note: When reinstalling components, make sure flange gaskets (if supplied) are in good condition and proper position. Replace gaskets where necessary. Inspect the catalyst module and catalyst retaining ring. The catalyst should be free of debris and the catalyst retaining ring should be tight.
1.	Cool Oxidizer to within 40 degrees of ambient temperature.
2.	Review and follow catalyst installation drawing and instructions.

Safety Instructions for Equipment Operation and Maintenance

PLEASE READ THIS ENTIRE SECTION BEFORE ATTEMPTING TO OPERATE OR PERFORM WORK ON THIS EQUIPMENT. FOLLOW THE INSTRUCTIONS CAREFULLY AND COMPLETELY. SAFETY IS THE RESPONSIBILITY OF EVERYONE.

This section describes safety instructions and general precautions to be followed when operating this equipment. This section also contains precautionary information to be heeded when performing maintenance, repairs or testing on the equipment. The information is intended as a guide to safe operation and maintenance of your system. It does not supersede or replace either the provisions of a safety program or any specific safety procedures established by the equipment user. Intellishare Environmental, Inc. has endeavored to use reasonable care and good judgment in identifying the potential hazards associated with this equipment. It is not possible to anticipate and address every hazardous situation. Neither can it address specific situations that may be unique to the user of the equipment. *Planning, concern, common sense, maturity and the elimination of careless practices is necessary in any safety program.*

Only properly trained and authorized personnel should be allowed to work on or around this equipment. It is the responsibility of the equipment user to establish appropriate safety health practices and to determine the applicable or regulatory limitations prior to use. All personnel involved with or affected by this equipment should read and understand this document, and all pertaining user supplied safety documents. It is strongly recommended that a barrier be erected around the equipment to deter unauthorized entrance into the installation area.

At no time shall any of the equipment controls be modified, bypassed or rendered inoperative without prior authorization from an Intellishare Environmental representative. To do so may result in equipment damage, personal injury or death.

This equipment has been designed and manufactured for use in conjunction with specific user equipment. The operation of this equipment under conditions outside of the original design, or with equipment other than the original design may be extremely hazardous. At no time should this equipment be used for anything other than its original design specifications. This equipment has been designed to discontinue operation in the event of an unexpected malfunction. Do not attempt to re-start the equipment until the source of the malfunction has been identified and eliminated.

Hazard Communication

Industry throughout the United States has established a uniform method for identifying the potential severity of a hazard. This method has also been further documented in various publications including those published by the American National Standards Institute. Intellishare Environmental, Inc. has used reasonable care to assure that the hazards included in this section conform to these established standards. The hazard levels are as follows:

(DANGER) An immediate hazard that will result in severe personal injury or death.

(WARNING) A hazard or unsafe practices which could result in severe personal injury or death.

(CAUTION) A hazard or unsafe practices which could result in minor personal injury, product damage, or property damage.

General Information (WARNING) Chemical Reactions

There are a number of hazards that inevitably occur due to the physical and chemical nature of the equipment. This equipment contains materials and chemical substances that may have adverse impact on the human body. Personnel responsible for the erection, maintenance and/or operation of this equipment should be knowledgeable and exercise care to provide protection against hazards to all affected personnel as well as equipment.

Electrical (DANGER) Electrocution

High voltage is present at many points of this equipment. Although every precaution has been taken to insure the safety of the operator, coming into contact with this voltage may result in serious injury or death. Only trained and qualified electricians should be allowed to work on the electrical components of this equipment. Observe all OSHA Lockout/Tagout requirements pertaining to this type of equipment to prevent accidental electrocution. The electrical power should be disconnected and locked out before entering into any electrical compartment. The equipment should be properly grounded and all interconnecting wiring should be installed in accordance with local, state and NEC codes.

Common system voltages include:

Ignition Circuits	6000+ Volts AC (Design Specific)
Electric Heater Circuits	208 / 240 / 480 Volts AC (Design Specific)
Motor Circuits	208 / 240 / 480 Volts AC (Design Specific)
Control Circuits	120 Volts AC (Design Specific)

Gas Train (DANGER) Fire or Explosion

Many of the equipment designs incorporate a natural gas or propane fuel train and burner to process contaminants. Unless authorized by a representative of Intellishare Environmental, do not attempt to modify or adjust components on the gas train. Personnel affected by this equipment should be trained on how to shut off the gas supply to the equipment in the event of a gas leak. Only trained and qualified personnel should be allowed to work on the gas train. Observe all OSHA Lockout/Tagout requirements pertaining to this type of equipment to prevent accidental releases of combustible gases. Observe all NFPA guidelines during installation, troubleshooting, and maintenance procedures performed on the equipment. Periodic inspection should be performed along with leak detection and indicator accuracy verification. System shutdown devices are incorporated into the gas train and these devices should be inspected periodically for proper operation. No open flame or spark emitting devices should be allowed in the area of the gas train.

High Temperature (CAUTION) Heat and Burns

Many of the equipment designs operate in a wide range of temperatures between 400° F and 1600° F. Although the equipment is insulated to reduce external surface temperatures, personnel should exercise caution when working on or around the equipment. Contact with hot surfaces may result in burn injuries. It is strongly recommended that the equipment be shut down and allowed to cool before any work is performed in this area.

Rotating Equipment (WARNING) Caught In or Struck By

Many of the equipment designs incorporate rotating components (i.e. motor drives, blowers, fans, etc...) into the design process. Use extreme caution when working on or around these components. Do not wear loose clothing or jewelry, and keep long hair protected. Observe all OSHA Lockout/Tagout requirements pertaining to this type of equipment to prevent accidental or automatic controlled starts. Remove all tools, electrical cords, and debris from the area before attempting to restart the equipment. Never attempt to repair or adjust rotating equipment while it is running. Always insure that all equipment guards are installed before attempting to start rotating equipment.

Confined Space (DANGER) Suffocation or Asphyxiation

The interior chambers of this equipment are confined space areas that may not contain enough oxygen to support human life. **Suffocation is possible.** According to OSHA guidelines, the minimum safe environment must contain at least 19.5 % oxygen for personnel to work in a confined space. The oxygen content in a normal environment is approximately 21%. In addition to the verification of oxygen content, it is extremely important to test the atmosphere within the confined space for hazardous chemical concentrations. **Asphyxiation is possible.** The atmosphere within the confined space must be checked for site-specific chemicals before entry is allowed. Observe all OSHA requirements pertaining to confined space before allowing personnel to enter these areas. **Do not enter into any confined space area until the atmosphere in that space has been tested by qualified personnel with the appropriate testing equipment.**

Slippery / Elevated Surfaces (CAUTION) Slips, Trips, or Falls

When working at elevations, observe the OSHA requirements for use of ladders, man-lifts, and safety restraint devices. Always be aware of slippery surfaces that may be caused by rain, snow, or ice. Do not climb on system piping or components as equipment damage or personal injury may occur.

Safety Precautions

The Intellishare Environmental, Inc. equipment and systems have been designed in such a manner as to present a minimum of safety hazards. It is, however, incumbent upon operating and maintenance personnel to follow safety procedures when in the area of the system and controls.

!! DANGER!

Never introduce concentrations exceeding 25% of the lower explosive limit (LEL) to a Catalytic Oxidizer.

Never introduce concentrations exceeding 50% of the LEL to a thermal oxidizer.

Operation >25% of the LEL must be accompanied by an LEL sensor alarm in accordance with NFPA Standards.

Avoidance of Potential Hazards

- Only competent, safety conscious personnel should have access to the area.
- Only qualified personnel should work on the electrical panel and controls. Follow all electrical and safety codes.
- Individuals working with this system must be familiar with the equipment and hazards involved and be fully trained in the operation of the equipment.
- All areas around the system must be restricted to authorized personnel only.
- Personnel in the area must wear safety equipment in compliance with plant and/or site safety standards.
- The system must be “shut down” and “locked out” before working on any part of the system. Possible injury to personnel could otherwise occur.
- All safety guards and devices must be correctly installed and in place before operating equipment.
- Do not touch the flame rod or spark ignitor, or ground the electrode while the oxidizer is operating. This is an electrical shock hazard.
- Check for gas leaks every week in the gas train and main gas line. A gas leak could produce a dangerous explosive condition. Repair all gas leaks immediately.
- Do not operate the oxidizer with the purge cycle shortened or bypassed. The purge cycle is factory-set for safe operation and must not be changed.
- Do not change damper or valve settings without first consulting Intellishare Environmental, Inc.

- Any fires that occur within the oxidizer and its related equipment should not be extinguished with water. Either a build-up of flammable substances or a faulty electrical circuit would most likely cause these fires. The proper fire fighting equipment must be available and operators must be trained in the use of the fire fighting equipment.

TERMS & WARRANTY

Standard Terms & Conditions

Prices

Prices are quoted in U.S. dollars and may be accepted only within 90 days from date of quotation by Intellishare Environmental, Inc. Quotations do not include taxes unless otherwise noted. Orders accepted prior to any price increase will be invoiced as quoted provided Intellishare Environmental is allowed to ship under its normal delivery schedule. Intellishare Environmental may adjust prices on any order changed by the Purchaser after acceptance of the order by Intellishare Environmental.

Cancellations

Orders cancelled by the Purchaser are subject to a cancellation charge which may include engineering service, work in progress, special purchased parts changes and other similar charges.

Shipping Schedules

Intellishare Environmental, Inc. will not be liable for any loss or damage from delays in shipping beyond Intellishare Environmental's reasonable control. Shipments delayed at Purchaser's request will be invoiced and dated on the day shipment is ready and a 1% per month service charge will be added. Intellishare Environmental reserves the right to make partial shipments and to invoice pro rata upon such shipments.

Electrical Equipment and Installation

Electrical equipment includes only those electrical components referred to in the quotation. Changes to electrical equipment to comply with any local, state, provincial or national regulations are the Purchaser's responsibility unless Intellishare Environmental specifically agrees to meet said regulations.

Acceptance and Testing of Equipment

Purchaser will upon delivery inspect and test the equipment and notify Intellishare Environmental in writing within 30 days of installation of all defects discovered, including failure of the equipment to meet quoted performance standards. Failure to give such notice constitutes irrevocable acceptance of the equipment, the equipment will be deemed to conform to the terms of this Agreement and Purchaser will be bound to pay for the equipment. Upon notification of a defect as above provided, Intellishare Environmental will repair the equipment and correct the system's performance.

Risk of Loss

Quotations are F.O.B., place of shipment, unless otherwise noted. The risk of loss of the equipment will pass to Purchaser upon Intellishare Environmental's delivery of the equipment to a carrier. Claims for damage in shipment must be filed by Purchaser with the carrier.

Limitation of Liability

In no event will Intellishare Environmental, its subcontractors or representatives, be held responsible, or liable for any claim, whether in warranty, contract, tort or strict liability for any special, indirect, incidental or consequential damages resulting from

the purchase of equipment (including but not limited to incidental or consequential damages for labor, lost profits, lost sales, injury to person or to property or any other incidental loss or damages).

Purchaser agrees that Purchaser's exclusive remedy and Intellishare Environmental's sole liability on any such claim will be limited to reimbursement from Intellishare Environmental of the purchase price actually received by Intellishare Environmental from Purchaser for the equipment in question.

Security Interest

Purchaser grants Intellishare Environmental a security interest in the equipment to secure payment of the balance due hereunder. Purchaser authorizes Intellishare Environmental to file this Agreement as a Financing Statement or to sign on behalf of Purchaser and file any other Financing Statements with respect to the equipment in any place Intellishare Environmental deems necessary.

Attorney's Fees

Purchaser will be liable for all reasonable expenses and attorney's fees incurred by Intellishare Environmental in enforcing its rights and remedies under this Agreement.

Ordinances

Any and all required licenses, certificates and operating permits will be the sole responsibility of the Purchaser unless otherwise specified by Intellishare Environmental, Inc.

Indemnification

Purchaser shall indemnify and save Intellishare Environmental, Inc. harmless against all losses or claims for bodily injury (including death) and property damage relating to the equipment or sustained by Seller while Seller or Seller's agents, employees or representatives are at a location selected by Purchaser except Purchaser shall not indemnify Seller if said damages are the result of Seller's willful and wanton acts.

Miscellaneous

The terms and conditions contained herein and any other terms and conditions stated in Intellishare Environmental's proposal or specifications attached hereto will constitute the entire agreement between Intellishare Environmental and Purchaser. The terms and conditions stated herein are applicable to all orders accepted by Intellishare Environmental, Inc. unless otherwise specifically agreed to by Intellishare Environmental in writing. Purchaser will be deemed to have assented to all such terms if any part of the described equipment is to be accepted. If Purchaser finds any terms not acceptable, Purchaser must so notify Intellishare Environmental within 10 days. Any additional or different terms contained in Purchaser's order to response hereto will be deemed objected to by Intellishare Environmental and will be of no effect. This proposal and its acceptance will be governed in all respects by the laws of Wisconsin. In the event of a breach, both parties agree that any suit will be brought in the jurisdiction of Wisconsin.

Warranty

Scope and Duration

Intellishare Environmental warrants to buyer that the products to be delivered will (a) be free from defects in material and manufacturing workmanship (b) conform to manufacturer's applicable product descriptions attached to Seller's quotation. If no product descriptions or specifications are attached to the quotation, manufacturer's specification in effect on the date of shipment will apply.

For oxidizers utilizing a catalyst, Intellishare Environmental guarantees the conversion efficiency of the system as long as the catalyst bed temperatures are kept within a specified range and certain neutralizers are kept out of the air stream. Please see accompanying list of catalyst poisons.

Purchaser is responsible to limit the introduction of hydrocarbon vapors, which exceed the LEL rating of the system as specified by the National Fire Protection Association (NFPA) & Intellishare Environmental. Detonation and damage as a result of LEL excess is solely the purchaser's responsibility.

Intellishare Environmental guarantees the conversion efficiency of the system or an outlet concentration of 20 ppmv as C1, whichever is less stringent.

The product warranties are for a period of 12 months from the date of shipment.

Intellishare Environmental shall rely on process and chemical information provided by Purchaser or its agents and shall not be liable for inaccurate data, undisclosed or unknown process or chemical materials.

Warranty Exclusions

Warranty coverage does not include (a) freight, labor, travel or living expenses associated with parts replacement (b) normal maintenance items such as lubrication, fan belts and cleaning of the equipment.

In the event the customer, or any installation contractor employed by the customer, contracts outside Intellishare Environmental for installation work or erection of quoted equipment, the customer will assume full responsibility for workmanship resulting from said contract.

Catalyst Deactivation & Poisoning Agents

The following partial list of poisoning agents and inhibitors has been found to have a detrimental effect on the activity of the noble metal catalyst. Catalyst exposure to these substances must be avoided. The catalyst manufacturer's warranty applies to all claims.

Substance	**Effect**	**Remedial Action**
Coating Agents - rust - dirt - inorganic oxide	Covers catalyst active site.	Non-phosphate detergent washing usually effective for removal. Factory reactivation or replacement usually required. Non-phosphate detergent washing may be effective.
Glass Forming Coating Agents - organic silicates (esters) - silicones - phosphorus containing materials	Covers catalyst active site.	Factory reactivation or replacement usually required. Non-phosphate detergent washing may be effective.
Poisons – Heavy Metal Complexes - Mercury - Lead - Zinc - Tin - Arsenic - Antimony, etc.	Permanent catalyst deactivation	Factory reactivation or replacement required.
Sulfides	Permanent catalyst deactivation	Depending on exposure and sulfide concentration, factory reactivation, non-phosphate detergent washing or replacement is required.
Halogens - fluorine - chlorine - bromine - iodine - halogenated hydrocarbons	Covers active site-resulting in temporary or permanent deactivation.	Activity usually returns if exposed to low concentrations and upon removal of halogen source. Prolonged exposure with water (or protons) can corrode, dissolve the catalyst substrate and require repair or replacement.
Note: Does not apply to HD or t-HD catalysts which have been specifically designed to be tolerant of and/or destroy halogenated hydrocarbons (excluding fluorine).		
Organic Droplets and Aerosols	Covers active site. Possible cause of catalyst hot spot.	Such materials may carburize on the catalyst forming a refractory material or become a hot spot source causing substrate deterioration. Factory reactivation or replacement is required.

Oxidation Catalyst Warranty & Limitation of Remedy & Liability

1. Johnson Matthey Environmental Products (JMEP), strictly for the period stated, warrants subject to all terms and conditions herein, that the catalyst furnished hereunder, when operated in accordance with the inlet conditions stated in attached TABLE I, shall provide minimum contaminant removal/destruction efficiency or not exceed maximum allowable unconverted contaminant concentration in the stack gas, as presented in TABLE I, whichever is less stringent. Any other performance curves submitted are for the Buyer's convenience and the performance indicated thereon is not offered by JMEP, nor to be construed by the Buyer as a proposal or contract obligation. The term "contaminant removal/destruction efficiency" shall be defined as that percentage of incoming hydrocarbon content oxidized to form carbon dioxide. Performance tests, if required, conducted at Purchaser's expense. Catalyst shall be considered accepted if tests show performance warranty has been fulfilled.

2. In the event the catalyst fails to perform as described in Paragraph 1 above, JMEP shall have the option of either; a) replacing FOB shipping point, the non-performing catalyst. B) providing FOB shipping point, additional catalyst. C) Make whatever repairs or modifications to the catalyst configuration it considers necessary to enable the catalyst to meet guarantees. The cost of providing such modifications, including materials, labor and engineering shall be borne by JMEP. Costs of installing modifications shall be borne by Buyer.

   In the event JMEP chooses to provide a replacement charge of catalyst, Buyer agrees to provide field installation for the new catalyst, return the original catalyst to JMEP and accept replacement catalyst as fulfillment of all obligations borne by JMEP and agrees to make no further demands.

   For the avoidance of doubt, the election by JMI of any of the above remedies shall not extend the warranty period.

3. The maximum liability of JMEP under this warranty shall not exceed the catalyst purchase price. JMEP, in no event shall be liable for production losses or indirect or consequential damages resulting from failure of catalyst to meet warranty.

4. The warranty period is Twelve (12) calendar months and shall commence from the date of initial start-up or from a date ninety (90) days after shipment, whichever date occurs first. Buyer agrees to promptly notify JMEP, in writing, as to the date of initial start-up.

5. a) The following contaminants are known catalyst deactivators and contribute to shortened catalyst life; heavy and base metals such as lead, mercury, arsenic, antimony, zinc, copper, tin, iron, nickel and chrome, sulfur and phosphorous. Hence the total content of these element(s) analyzed on the catalyst by quantitative methods must not exceed 10 grams/ft3 with the exceptions shown below in 5©. Contaminants in excess of these amounts shall void the warranty unless failure is due solely to defects in the equipment.

   b) Exposure to excessive temperatures significantly reduces catalyst life. Hence, at no time shall the catalyst outlet temperature be permitted to exceed 1250 F. Normal continuous operating temperature shall not exceed 1200 F for more than 15 minutes during any 24 hour period. Exposure to temperatures exceeding these values will automatically void the warranty. It is for this reason that the use of a high temperature alarm set for 1200 F and shutdown system set for 1250 F along with a temperature recorder is recommended.

   c) Chlorine containing compounds in the exhaust must not exceed 10 ppm. Silicon and fluorine containing compounds must be absent. Contaminants in excess of these amounts shall void the warranty.

   d) Periodic cleaning of particulates, etc., may be found necessary to maintain catalyst activity. If required, this shall not be construed as evidence of catalyst non-performance. Buyer shall conduct catalyst cleaning in strict accordance with JMEP procedure during warranty period.

6. Unit must be designed such that 1) no bypass around catalyst blocks or catalyst bed can occur, 2) blocks are oriented according to JM's recommendations, 3) flow is evenly distributed across catalyst bed. Failure to do so shall void the warranty.

7. Except as stated above, in the equipment warranty, and in the standard terms and conditions of sale, JMEP makes no other warranties, expressed or implied, including the implied warranties of merchantability and fitness for any particular purpose.

- The foregoing is Seller's only obligation and Buyer's exclusive remedy for breach of warranty and, except for gross negligence, willful misconduct and remedies permitted under the performance, inspection and acceptance and the patent clauses hereof, the foregoing is Buyer's exclusive remedy against Seller for all claims arising hereunder or relating hereto whether such claims are based on breach of contract, (or) (including negligence and strict liability) or other theories.

  Buyer's failure to submit a claim as provided above shall specifically waive all claims based on latent defects. In no event shall Buyer be entitled to incidental or consequential damages. Any action arising hereunder or relating hereto whether based on breach of contract (or) (including negligence and strict liability) or other theories, must be commenced within one (1) year after the cause of action accrues or it shall be barred.

MECHANICAL DRAWINGS

Process & Instrumentation Diagram (P&ID)

General Arrangement Drawing

Oxidizer Installation Drawing

Catalyst Installation Drawing

(Catalyst optionally available)

LOGIC SEQUENCE

System Pre-Start			
Step	**Display**	**Operator Action**	**Remarks**
1	No Message	Turn On Main Power	Once main power voltage and phase has been verified, engage power disconnect.
2	System Off Check Control Power and E-Stop (Only when enabled)	Turn On Control Power & Pull E-Stop Switch Out. Press Reset (F4) to clear any alarms.	120VAC control power is applied to PLC outputs and other external devices. The following pre-start safe conditions must be met prior to the "System Ready to Start" state is achieved. -E-Stop -Control Power -Temperature Control Valve TCV-1, closed -Gas Train Blocking Valve, closed -Gas Pressure Switches satisfied **Warning:** Prior to starting the oxidizer close all SVE well valves and fully open the SVE dilution valve. Confirm the SVE automatic dilution valve is full open. Failure to close the SVE wells can result in damage to equipment and can cause injury to personnel. **Warning:** High concentrations of hydrocarbons can cause detonation and damage to the equipment or injury to personnel. Only trained operators should be allowed to operate and adjust the system.

System Start-Up

Step	Display	Operator Action	Remarks
1	System Ready to Start	Push START Button (F1).	Operator may abort the start-up sequence by pressing the stop or reset on the operator display or the emergency stop button located on the exterior of the control panel. Automatic startup sequence is initiated. With no alarm condition present and all safe limits proven, the system fan is started.
2	Burner Enabled Flame Not Established	None. Automatic operation.	SVE/AS run contact is enabled. System purges for 30 seconds, controlled by flame safety. The controls check to assure that; -System fan running contacts close -System gas booster running contacts close -System air flow is proven -Gas pressure switches are satisfied -Catalyst DP is satisfied, (if equipped) -Main fuel valve is proven closed -Temperature limits are satisfied -SVE/AS run signal is satisfied. Once air flow is proven and the purge timer has expired, the burner pilot gas valve is opened and fuel is introduced to the pilot flame port. The burner ignition transformer is turned on and the spark igniter attempts to light the pilot flame. Once the burner pilot flame is established the spark ignition is disabled. The flame controller assures the flame stability. The main gas valves are opened and main gas supply is opened to the burner. Note: Verify air flow to the oxidizer is within maximum air flow requirements. Oxidizer process inlet should always be under negative pressure of -2 to 5” w.c.
3	Burner On. Heating to Setpoint	None. Automatic	The firing rate valve modulates to drive and hold the oxidizer temperature to a field adjustable set point on the inlet temperature control device.

4	Burner On. Soaking at Set Point	None Automatic	Once the minimum operating temperature is achieved on the outlet temperature controller (1350 deg F for thermal mode) a 120 second PLC timer is activated to allow the oxidizer to reach a steady state. Dilution air damper control is enabled.

Putting the System On-Line			
Step	**Display**	**Operator Action**	**Remarks**
1	Burner On Inlet Opened	Open SVE Wells and or begin treating water	**Warning:** Always open the SVE wells slowly. High concentrations can cause detonation and damage to the equipment or injury to personnel. Only trained operators should be allowed to operate and adjust the system.
System Shut-Down			
1	Cool Down	Push SYSTEM STOP button (F2).	The oxidizer enters into the shutdown mode. The burner is disabled, the SVE interlock relay is de-energized, the dilution damper is driven open and the combustion fan remains on to cool the reactor.
2	Cool Down 240 Seconds	None. Automatic operation.	The combustion fan is shut off after a timed cool-down period.
3	"System Ready to Start"	- - - - - -	The system may be re-started.

System Run Time			
1	None	Push RUN TIME Button (>).	Press RUN TIME button to display system operating hours. 10 second timer automatically resets screen.
System Stand-by (Disabled)			
1	Standby	Push Standby Button (F3)	Pressing the Standby button opens the automatic dilution valve. The oxidizer to system ready continues to be enabled and the SVE/AS alarm from others panel is ignored. Push Stand-by mode again to return to “Burner on System inlet open”

Alarm Conditions

Each of the following alarm conditions initiates 240 second cool-down. Exceptions are emergency stop and control power, which initiates a hard shutdown.

The alarm which first causes a shutdown is the one displayed. Subsequent faults are disregarded by the controls until the first alarm is cleared. Note: Some alarms may not be present in every system.

Display	Description	Operator Action
High L.E.L. After Correcting Fault, Press RESET.	The LEL monitor has detected an LEL in excess of 50% in the process airstream.	Check for: -Concentrations too high. -Proper dilution operation.
Inlet Temperature High After Correcting Fault, Press RESET.	The inlet temperature has risen above the alarm setpoint. Excess temperature can damage or destroy the catalyst. It can also damage the reactor or scrubber if equipped.	Check for: - Malfunctioning firing rate actuator, loose or broken linkage. - Proper setup, function of inlet temperature control loop. -Proper air flow rate
Outlet Temperature High After Correcting Fault, Press RESET.	The combustion chamber or catalyst outlet temperature has risen above the alarm setpoint. Excess temperature can damage or destroy the catalyst. It can also damage the reactor or scrubber.	Check for: - Malfunctioning dilution air actuator, loose or broken linkage. - Proper setup, function of outlet temperature control loop. - High solvent loading in process air stream.
System Operating Temperature Lost, Press RESET.	Once the system operating temperature is reached a 5 minute timer is enabled to allow the system to recover and reach operating temperature.	Check for: -Low inlet gas pressure. -Proper air flow rate. -Malfunctioning firing rate actuator, loose or broken linkage.
System Ready Temperature Not Reach, Press RESET.	Once the system is enabled it has 60 minutes to reach operating temperature.	Check for: Low inlet gas pressure. -Proper air flow rate. -Malfunctioning firing rate actuator or broken linkage.
Low Gas Pressure at Gas Booster. After Correcting Fault, Press RESET.	Low inlet gas pressure has been detected at the inlet of the gas booster.	Check for: -Gas supply valves closed. -Improper switch setting. -Faulty gas booster.

Alarm Conditions (continued)

Display	Description	Operator Action
Aux. Interrupt Fault. After Correcting Fault, Press RESET.	The customer auxiliary interlock has opened. This is a dry contact site equipment interlock provided by the customer. It is used to shut down the oxidizer when necessary according to site equipment failure or other condition(s).	Check for cause.
Water Level High. After Correcting Fault, Press RESET.	High water level in the knock-out pot.	Check for: -Drain the knock-out pot.
System Blower Motor Off. After Correcting Fault, Press RESET.	The SVE blower motor starter has failed to energize on startup or has opened while the motor was running.	Check for: - High motor current draw. - Fan obstruction. - Seized fan or motor bearings. - Fan out of balance.
Combustion Blower Motor Off. After Correcting Fault, Press RESET.	The combustion blower motor starter has failed to energize on startup or has opened while the motor was running.	Check for: - High motor current draw. - Fan obstruction. - Seized fan or motor bearings. - Fan out of balance.
Gas Booster Motor Off. After Correcting Fault, Press RESET.	The gas booster motor starter has failed to energize on startup or has opened while the motor was running.	Check for: - High motor current draw. - Fan obstruction. - Seized fan or motor bearings. - Fan out of balance.
System Air Switch Not Closed. After Correcting Fault, Press RESET.	The system air proving switch has failed to close on startup or has opened after airflow was proven.	Check for: - Airflow restriction, such as a closed damper or debris. - Plugged airflow sensing tubing. - System fan malfunction.
Catalyst High Differential Pressure. After Correcting Fault, Press RESET.	The differential pressure across the catalyst has risen above the setpoint of the proving switch.	Check for: - Excess airflow through the oxidizer. - Catalyst fouling. - Plugged airflow sensing tubing.

Alarm Conditions (continued)

Display	Description	Operator Action
Flame Failure. After Correcting Fault, Press RESET.	The Honeywell flame safety programmer (FSG) has detected a fault condition. Requires manual reset of FSG located on control panel interior.	Check for: -UV Scanner operating properly. -Improper gas pressure -Malfunctioning spark ignitor
Low Gas Pressure. After Correcting Fault, Press RESET.	Low inlet gas pressure has been detected.	Check for: -Gas supply valves closed. -Improper switch setting. -Faulty main gas regulator.
High Gas Pressure. After Correcting Fault, Press RESET.	High gas pressure has been detected.	Check for: -Gas supply valves closed. -Faulty main gas regulator. -Improper switch setting.

ELECTRICAL DRAWINGS

CONTROLLER SET POINTS

Inlet Temperature Control

Group Prompt	Function Prompt	Value or Selection	Factory Setting
TUNING	PB or GAIN	PB 15	1.0
	RATE T	0.00	0.00
	I MIN or I RPM	1.0	1.0
	MANRST	Not Used	1.0
	PB2 or GAIN 2	Not Used	0.0
	RATE2T	Not Used	0.00
	I2 MIN or I2 RPM	Not Used	1.0
	CYCT1 or CT1	Not Used	20
	X3	Not Used	20
	CYC2T2 or CT2	Not Used	20
	X3	Not Used	20
	SECUR	Not Used	0
	LOCK	NONE	NONE
	AUTOMA	ENAB	ENAB
	A TUNE	DIS	ENAB
	RN HLD	DIS	ENAB
	SP SEL	DIS	ENAB

Group Prompt	Function Prompt	Value or Selection	Factory Setting
SPRAMP	SPRAMP	DIS	DIS
	TI MIN	Not Used	3
	FINLSP	Not Used	1000
	SPRATE	ENAB	DIS
	EUHRUP	8400	0
	EUHRDN	Not Used	0
	SPPROG	DIS	DIS

Group Prompt	Function Prompt	Value or Selection	Factory Setting
ATUNE	FUZZY	ENAB	DIS
	TUNE	DIS	TUNE
	DUPLEX	MAN	MAN
	AT ERR	Not Used	---

Group Prompt	Function Prompt	Value or Selection	Factory Setting
ALGOR	CTRALG	PIDA	PIDA
	TIMER	DIS	DIS
	PERIOD	Not Used	0:01
	START	Not Used	KEY
	L DISP	Not Used	TREM
	RESET	Not Used	KEY
	INCRMT	Not Used	MIN

Group Prompt	Function Prompt	Value or Selection	Factory Setting
OUTLAG	OUTLAG	CUR	(MOXL)
	4-20RG	Not Used	100
	CRANGE	4-20	4-20
	RLY TY	Not Used	MECH
	MTRT1	Not Used	5

Group Prompt	Function Prompt	Value or Selection	Factory Setting
INPUT1	IN1TYP	KH	KH
	XMITR1	Not Used	LIN
	IN1 HI	2400	2400
	IN1 LO	0	0
	RATIO1	1.0	1.00
	BIAS1	0.0	0.0
	FILTR1	5	1.0
	BRNOUT	UP	UP
	EMIS	1.0	1.0

Group Prompt	Function Prompt	Value or Selection	Factory Setting
INPUT2	IN2TYP	Not Used	1-5V
	LIN	Not Used	LIN
	IN2 HI	Not Used	2400
	IN2 LO	Not Used	0
	RATIO2	Not Used	1.00
	BIAS 2	Not Used	0.0
	FILTR2	Not Used	1.0

Inlet Temperature Control (continued)

Group Prompt	Function Prompt	Value or Selection	Factory Setting
CONTRL	PIDSET	ONE	ONE
	SW VAL	Not Used	0.00
	LSP'S	TWO	ONE
	RSPSRC	Not Used	NONE
	SP TRK	NONE	NONE
	PWR UP	ALSP	AUTO
	PWROUT	Not Used	FSAF
	SP Hi	1600	2400
	SP Lo	0	0
	ACTION	REV	REV
	OUT Hi	100	100
	OUT Lo	0	0
	D BAND	2.0	2.0
	HYST	0.5	0.5
	FAILSF	0	0.0
	FSMODE	LATCH	NOL
	PBorGN	PB	GAIN
	MINRPM	RPM	MIN

Group Prompt	Function Prompt	Value or Selection	Factory Setting
OPTION	AUXOUT	IN1	DIS
	ARANGE	4-20	4-20
	0 PCT	0	0
	100 PCT	2000	100
	DIG IN 1	NONE	NONE
	DIG1 COM	DIS	DIS
	DIG IN 2	NONE	NONE
	DIG2 COM	DIS	DIS

Group Prompt	Function Prompt	Value or Selection	Factory Setting
COM	ComADR	Not Used	Disable
	COMSTA	Not Used	0
	IRENAB	Not Used	Enable
	BAUD	Not Used	9600
	TX_DLY	Not Used	30
	WS_FLT	Not Used	FP_B
	SDENAB	Not Used	Enable
	SHDTIM	Not Used	0
	SDMODE	Not Used	Last
	SHD_SP	Not Used	LSP
	UNITS	Not Used	PCT
	CSRATO	Not Used	1.0
	CSP_BI	Not Used	0
	LOOPBACK	Not Used	Disable

Group Prompt	Function Prompt	Value or Selection	Factory Setting
ALARMS	A1S1TY	IN1	NONE
	A1S1VA	1600	90
	A1S1HL	HIGH	HIGH
	A1S1EV	Not Used	BEGN
	A1S2TY	Not Used	NONE
	A1S2VA	Not Used	90
	A1S2HL	Not Used	HIGH
	A1S2EV	Not Used	BEGN
	A2S1TY	IN1	NONE
	A2S1VA	1350	90
	A2S1HL	HIGH	HIGH
	A2S1EV	Not Used	BEGN
	A2S2TY	Not Used	NONE
	A2S2VA	Not Used	90
	A2S2HL	Not Used	HIGH
	A2S2EV	Not Used	BEGN
	ALHYST	0.1	0.0
	ALARM1	NOL	NOL
	BLOCK	DIS	DIS
	DIAGL	DIS	DIS

Inlet Temperature Control (continued)

Group Prompt	Function Prompt	Value or Selection	Factory Setting
DISPLY	DECMAL	NONE	NONE
	UNITS	F	F
	FREQ	60	60
	NOLDSP	DIS	DIS
	DISPLY	1400	SP
	2nd SP	70	2L
	LNGUAG	ENGL	ENGL

Notes:

1) Controller should be set to the automatic position. To change between the manual and automatic position, depress the M-A/Reset Button and observe the M or A indicated on the right middle area of the screen.

2) Enter in the Set Point temperature by pushing the Lower Display button until SP appears in lower left corner.

3) Read Status: Skip

4) Program control before tuning setup.

Outlet Temperature Control

Group Prompt	Function Prompt	Value or Selection	Factory Setting
TUNING	PB or GAIN	PB 15	1.0
	RATE T	0.00	0.00
	I MIN or I RPM	1.0	1.0
	MANRST	Not Used	1.0
	PB2 or GAIN 2	Not Used	0.0
	RATE2T	Not Used	0.00
	I2 MIN or I2 RPM	Not Used	1.0
	CYCT1 or CT1	Not Used	20
	X3	Not Used	20
	CYC2T2 or CT2	Not Used	20
	X3	Not Used	20
	SECUR	Not Used	0
	LOCK	CAL	NONE
	AUTOMA	ENAB	ENAB
	A TUNE	DIS	ENAB
	RN HLD	DIS	ENAB
	SP SEL	DIS	ENAB

Group Prompt	Function Prompt	Value or Selection	Factory Setting
SPRAMP	SPRAMP	DIS	DIS
	TI MIN	Not Used	3
	FINLSP	Not Used	1000
	SPRATE	DIS	DIS
	EUHRUP	Not Used	0
	EUHRDN	Not Used	0
	SPPROG	Not Used	DIS

Group Prompt	Function Prompt	Value or Selection	Factory Setting
ATUNE	FUZZY	ENAB	DIS
	TUNE	DIS	TUNE
	DUPLEX	Not Used	MAN
	AT ERR	Not Used	---

Group Prompt	Function Prompt	Value or Selection	Factory Setting
ALGOR	CTRALG	PIDA	PIDA
	TIMER	DIS	DIS
	PERIOD	Not Used	0:01
	START	Not Used	KEY
	L DISP	Not Used	TREM
	RESET	Not Used	KEY
	INCRMT	Not Used	MIN

Group Prompt	Function Prompt	Value or Selection	Factory Setting
OUTLAG	OUTLAG	CUR	(MOXL)
	4-20RG	Not Used	100
	CRANGE	4-20	4-20
	RLY TY	MECH	MECH
	MTRT1	5	5

Group Prompt	Function Prompt	Value or Selection	Factory Setting
INPUT1	IN1TYP	KH	KH
	XMITR1	Not Used	LIN
	IN1 HI	2400	2400
	IN1 LO	0	0
	RATIO1	1.0	1.00
	BIAS1	0.0	0.0
	FILTR1	5	1.0
	BRNOUT	UP	UP
	EMIS	1.0	1.0

Group Prompt	Function Prompt	Value or Selection	Factory Setting
INPUT2	IN2TYP	Not Used	1-5V
	LIN	Not Used	LIN
	IN2 HI	Not Used	2400
	IN2 LO	Not Used	0
	RATIO2	Not Used	1.00
	BIAS 2	Not Used	0.0
	FILTR2	Not Used	1.0

Outlet Temperature Control
(continued)

Group Prompt	Function Prompt	Value or Selection	Factory Setting
CONTRL	PIDSET	ONE	ONE
	SW VAL	Not Used	0.00
	LSP'S	ONE	ONE
	RSPSRC	Not Used	NONE
	SP TRK	NONE	NONE
	PWR UP	ALSP	AUTO
	PWROUT	Not Used	FSAF
	SP Hi	1600	2400
	SP Lo	0	0
	ACTION	REV	REV
	OUT Hi	100	100
	OUT Lo	0	0
	D BAND	2.0	2.0
	HYST	0.5	0.5
	FAILSF	0.0	0.0
	FSMODE	LATCH	NOL
	PBorGN	PB	GAIN
	MINRPM	RPM	MIN

Group Prompt	Function Prompt	Value or Selection	Factory Setting
OPTION	AUXOUT	IN1	DIS
	ARANGE	4-20	4-20
	0 PCT	0	0
	100 PCT	1600 or 2000	100
	DIG IN 1	NONE	NONE
	DIG1 COM	DIS	DIS
	DIG IN 2	NONE	NONE
	DIG2 COM	Not Used	DIS

Group Prompt	Function Prompt	Value or Selection	Factory Setting
COM	ComADR	Not Used	Disable
	COMSTA	Not Used	0
	IRENAB	Not Used	Enable
	BAUD	Not Used	9600
	TX_DLY	Not Used	30
	WS_FLT	Not Used	FP_B
	SDENAB	Not Used	Enable
	SHDTIM	Not Used	0
	SDMODE	Not Used	Last
	SHD_SP	Not Used	LSP
	UNITS	Not Used	PCT
	CSRATO	Not Used	1.0
	CSP_BI	Not Used	0
	LOOPBACK	Not Used	Disable

Group Prompt	Function Prompt	Value or Selection	Factory Setting
ALARMS	A1S1TY	NONE	NONE
	A1S1VA	Not Used	90
	A1S1HL	Not Used	HIGH
	A1S1EV	Not Used	BEGN
	A1S2TY	NONE	NONE
	A1S2VA	Not Used	90
	A1S2HL	Not Used	HIGH
	A1S2EV	Not Used	BEGN
	A2S1TY	Not Used	NONE
	A2S1VA	Not Used	90
	A2S1HL	Not Used	HIGH
	A2S1EV	Not Used	BEGN
	A2S2TY	NONE	NONE
	A2S2VA	Not Used	90
	A2S2HL	Not Used	HIGH
	A2S2EV	Not Used	BEGN
	ALHYST	0.1	0.0
	ALARM1	NOL	NOL
	BLOCK	DIS	DIS
	DIAGL	DIS	DIS

Outlet Temperature Control
(continued)

Group Prompt	Function Prompt	Value or Selection	Factory Setting
DISPLY	DECMAL	NONE	NONE
	UNITS	F	F
	FREQ	60	60
	NOLDSP	DIS	DIS
	DISPLY	1500	SP
	LNGUAG	ENGL	ENGL

Notes:

1) Controller should be set to the automatic position. To change between the manual and automatic position, depress the M-A/Reset Button and observe the M or A indicated on the right middle area of the screen.

2) Enter in the Set Point temperature by pushing the Lower Display button until SP appears in lower left corner. SP should read 1500.

3) Read Status: Skip

4) Program control setup before tuning setup.

Flow Sensor Calculation Information

Pitot Tube Location:	Fan Exhaust
Pitot Tube Model Number:	DS-300-6
Magnehelic Gauge Scale:	0-2” w.c.
Duct Diameter:	6”
Flow Coefficient:	0.665
Barometric Pressure:	29.28”/23.53” HG
Duct Temperature:	100˚ F.
Duct Static Pressure:	12” w.c.

Flow Sensor Conversion Chart

Differential Pressure	**SCFM 800’ MSL**	**SCFM 6500’ MSL**
.1	163	147
.2	231	208
.3	276	248
.4	326	294
.5	365	329
.6	400	360
.7	432	389
.8	462	416
.9	490	441
1.0	516	465
1.1	541	488
1.2	565	509
1.3	588	530
1.4	611	550
1.5	632	569
1.75	683	615
2.0	730	658

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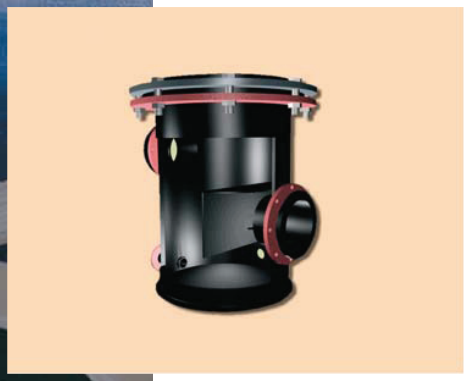

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High-Density Polyethylene Pipe

Introduction

ISCO Industries, LLC is the largest high-density polyethylene pipe distributor in North America. ISCO can serve your needs anywhere in the USA and internationally. ISCO offers a complete package of HDPE piping products. Butt fusion machines are offered for sale or rental. Fusion technicians are available to provide on-site training or assistance to your project. Please call 1-800-345-ISCO for all your HDPE piping needs.

Some of The Characteristics of HDPE Pipe are:

- Economical
- Corrosion Resistant
- Zero Leak-Rate
- Hydraulically Smooth
- Fatigue and Surge Resistant
- Long Design Life
- Tappable
- Chemically Resistant
- Easily Installed
- Small to Large Diameters
- Non-Toxic, Non-Tasting
- Lightweight
- Reliable
- Flexible and Coilable
- Heat Fused
- Mechanically Joined (As Needed)
- Strong and Ductile
- Weather Resistant
- Impact Resistant
- Freeze Resistant
- Durable
- Abrasion Resistant
- Inert
- Self Restrained Pipe (Monolithic)
- Listed and Approved

Important Standards for High Density Polyethylene (HDPE) Pipe

Standards important for HDPE pipe relate to the resin the pipe is made from and the standards related to manufacturing sizes and tolerances. The American Society of Testing Materials (ASTM) standard for resin from which the pipe is made is **ASTM D 3350-05**, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials. This standard defines the physical properties of the resin that the pipe is made from.

Pipe dimensions and manufacturing requirements:

ASTM F 714-05 Standard Specification for Polyethylene (PE) Pipe (SDR-PR) Based on Outside Diameter. This standard is used for most large diameter HDPE pipe (4" to 63") applications other than gas pipe.

ASTM D 2513-05 Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing and Fittings. Polyethylene pipe and other plastic for natural gas distribution are described in great detail in this standard.

ASTM D 3035-03a Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter. Most HDPE water tubing (1/2 inch to 3") is made to the dimensions in this standard. While pipe sizes up to 24" are provided, very little large diameter pipe is made to this standard.

Intallation Standards:

ASTM D 2321-05 Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications

ASTM D 2774-04 Standard Practice for Underground Installation of Thermoplastic Pressure Piping

ASTM F 1962 Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe or Conduit under Obstacles, Including River Crossings

ASTM F 585-94 Standard Practice for Insertion of Flexible Polyethylene Pipe into Existing Sewers

American Water Works Association Standards

ANSI/AWWA C 901-2005 Polyethylene Pressure Pipe and Tubing, .5 in (13 mm) Through 3 in. (76 mm) for Water Services

ANSI/AWWA C 906-2006 Polyethylene Pipe and Fittings, 4 in (100 mm) Through 63 In (1,575 mm) for Water Distribution

Pipe Joining Standards:

ASTM F 2620 – Standard Practice for Heat Fusion of Polyethylene Pipe and Fittings

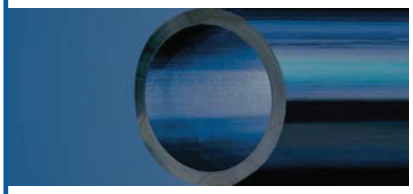
ASTM D 2657 – Standard Practice of Heat Fusion Joining of Polyolefin Pipe and Fittings

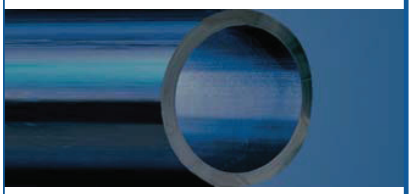
ASTM F 1290 – Standard Practice for Electrofusion Joining Polyolefin Pipe and Fittings

Fitting Standards

ASTM D 3261 Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Butt Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing

ASTM F 1055 Standard Specification for Electrofusion Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing





HDPE Pipe

Specifications for HDPE Pipe

The physical properties of high-density polyethylene pipe are described using ASTM D 3350-05, "Standard Specification for Polyethylene Plastic Pipe and Fittings Materials". Recently this standard was changed. The two key areas changed are, density and slow crack growth. In the 05 version, the cell classifications for density were increased from four cells to seven cells defining the density ranges for various resins.

New high performance bimodal resins, PE 4710 resins, have higher PENT test values. Slow crack grow properties can now be defined using eight cells.

As of December 2006, most HDPE pipe is made from resin with a cell classification of PE 345464C. The pipe is labeled as PE3408/3608. The physical properties for PE 345464C are:

PROPERTY VALUE		SPECIFICATION	UNIT	NOMINAL VALUE
Material Designation		PPI / ASTM		PE3408
Material Designation		PPI / ASTM		PE 3408/3608
Cell Classification		ASTM D 3350		345464C
Density	(3)	ASTM D 1505	g/cm3	0.941-943
Melt Index	(4)	ASTM D 1238	gm/ 10 min	0.05 -.11
Flexural Modulus	(5)	ASTM D 790	psi	110,000 to 140,000
Tensile Strength	(4)	ASTM D 638	psi	3,200
Slow Crack Growth				
ESCR		ASTM D 1693	hours in 100% igepal	>5,000
PENT	(6)	ASTM F 1473	hours	>100
HDB @ 73 deg F	(4)	ASTM D 2837	psi	1,600
UV Stabilizer	(C)	ASTM D 1603	%C	2 to 2.5%

The density provided is without carbon black. Typical HDPE pipe has a density of .955 to .957 with carbon black.

Types of Polyethylene Pipe

All polyethylene (PE) is not the same. In ASTM D 3350-05, low density PE is defined as having a density range of 0.919 to 0.925 g/cc; medium density has a range of 0.926 to 0.940 g/cc and high density is defined with a range from 0.941 to 0.955. All densities are without carbon black.

Density influences key properties in polyethylene materials. As the density increases, the tensile strength increases; also chemical resistance increases.

Medium density PE resins have been used for gas distribution. This original selection was made based on superior slow crack growth properties of medium density resins. Medium density pipe is designated as PE 2406 and PE 2708.

Today new bimodal resins are being used in gas distribution because of higher pressure ratings plus superior slow crack growth. These resins are designated PE 3408, PE 3608, PE 3708, PE 3710 and PE 4710.

Slow Crack Growth
The Pent test is used to determine stress crack resistance for PE resins. The PENT test is conducted in accordance with ASTM F 1473, "Standard Test Method for Notch Tensile Test to Measure the Resistance to Slow Crack Growth of Polyethylene Pipes and Resins". This test uses a solid sample of material which is notched and tested.

The PENT test is a good test of slow crack growth. Scratches and gouges can cause crack propagation. Materials with high PENT numbers are less likely to fail because of slow crack growth.

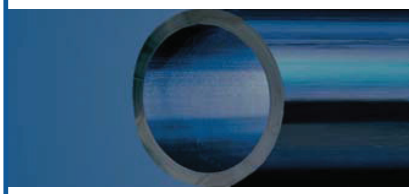
Traditional PE 3408/3608 resins have PENT test values of about 100 hours. New bimodal resins used to make PE 3710 and PE 4710 pipes have values ranging from 600 hours to several thousand hours.

Physical Properties of PE 4710
HDPE pipe with a designation of PE 4710 is made from resin with a cell classification of PE 445474C or PE 445574C. We suggest using a specification calling for a minimum cell classification of PE 445474 C or higher. Both cell classifications can be used if specified in this way. The pipe is labeled as PE 4710. The physical properties for PE 445474C are provided below:

PROPERTY VALUE		SPECIFICATION	UNIT	NOMINAL VALUE
Material Designation		PPI / ASTM		PE 4710
Cell Classification		ASTM D 3350		445474 C
Density	(4)	ASTM D 1505	g/cm3	0.947-955
Melt Index	(4)	ASTM D 1238	gm/ 10 min	<.15
Flexural Modulus	(5)	ASTM D 790	psi	110,000 to 160,000
Tensile Strength	(5)	ASTM D 638	psi	3500-4000
Slow Crack Growth				
ESCR		ASTM D 1693	hours in 100% igepal	>5,000
PENT	(7)	ASTM F 1473	hours	>500
HDB @ 73 deg F	(4)	ASTM D 2837	psi	1,600
UV Stabilizer	(C)	ASTM D 1603	%C	2 to 2.5 %

The density provided is without carbon black. Typical PE 4710 HDPE pipe has a density of 0.956 to 0.964 with carbon black.

To be called a PE 4710, the pipe and resin has substantiation at 50 years.



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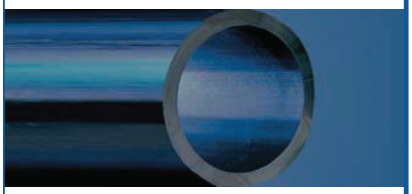

HDPE Pipe

- **Items highlighted in Blue indicates standard stocking items that are more readily available.**
- **Pressures are based on using water at 23°C (73°F).**
- **Average inside diameter calculated using nominal OD and minimum wall plus 6% for use in estimating fluid flows. Actual ID will vary.**
- **Other piping sizes or DR's may be available upon request.**
- **Standard Lengths: 40' for 2"-24" 50' for 26" and larger Coils available for 3/4"-6"(8" by special order)**

1-800-345-ISCO

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PE 3608/3408 IPS HDPE Pipe Sizes

Pressure Rating	Nominal Size / Actual O.D.	3/4" 1.05"	1" 1.315"	1 1/4" 1.66"	1 1/2" 1.90"	2" 2.375"	3" 3.50"	4" 4.50"	5" 5.375"	5" 5.563"	6" 6.625"	7" 7.125"	8" 8.625"	10" 10.75"	12" 12.75"	14" 14.00"	16" 16.00"	18" 18.00"
DR 7 (267psi)	Min. wall	0.150"	0.188"	0.237"	0.271"	0.339"	0.500"	0.643"	0.768"	0.795"	0.946"	1.018"	1.232"	1.536"	1.821"	2.000"	2.286"	2.571"
	Average I.D.	0.732"	0.917"	1.157"	1.325"	1.656"	2.440"	3.137"	3.747"	3.878"	4.619"	4.967"	6.013"	7.494"	8.889"	9.760"	11.154"	12.549"
	Weight lb/lf	0.184	0.289	0.460	0.603	0.943	2.047	3.384	4.830	5.172	7.336	8.195	12.433	19.314	27.170	32.758	42.786	54.151
DR 7.3 (254psi)	Min. wall	0.144"	0.180"	0.227"	0.260"	0.325"	0.479"	0.616"	0.736"	0.762"	0.908"	0.976"	1.182"	1.473"	1.747"	1.918"	2.192"	2.466"
	Average I.D.	0.745"	0.933"	1.178"	1.348"	1.685"	2.484"	3.193"	3.814"	3.947"	4.701"	5.056"	6.120"	7.628"	9.047"	9.934"	11.353"	12.773"
	Weight lb/lf	0.178	0.279	0.444	0.582	0.762	1.656	2.737	4.663	4.182	5.932	8.200	10.054	15.618	21.970	26.489	34.598	43.788
DR 9 (200psi)	Min. wall	0.117"	0.146"	0.184"	0.211"	0.264"	0.389"	0.500"	0.597"	0.618"	0.736"	0.792"	0.958"	1.194"	1.417"	1.556"	1.778"	2.000"
	Average I.D.	0.803"	1.005"	1.269"	1.452"	1.816"	2.676"	3.440"	4.109"	4.253"	5.064"	5.447"	6.593"	8.218"	9.747"	10.702"	12.231"	13.760"
	Weight lb/lf	0.150	0.234	0.372	0.488	0.762	1.656	2.737	3.903	4.182	5.932	6.863	10.054	15.618	21.970	26.489	34.598	43.788
DR 11 (160psi)	Min. wall	0.095"	0.120"	0.151"	0.173"	0.216"	0.318"	0.409"	0.489"	0.506"	0.602"	0.648"	0.784"	0.977"	1.159"	1.273"	1.455"	1.636"
	Average I.D.	0.848"	1.062"	1.340"	1.534"	1.917"	2.825"	3.633"	4.339"	4.491"	5.348"	5.752"	6.963"	8.678"	10.293"	11.302"	12.916"	14.531"
	Weight lb/lf	0.125	0.197	0.312	0.409	0.639	1.387	2.294	3.272	3.505	4.971	5.750	8.425	13.089	18.412	22.199	28.994	36.696
DR 13.5 (128psi)	Min. wall	---	---	---	---	0.176"	0.259"	0.333"	0.398"	0.412"	0.491"	0.528"	0.639"	0.796"	0.944"	1.037"	1.185"	1.333"
	Average I.D.	---	---	---	---	2.002"	2.950"	3.793"	4.531"	4.689"	5.585"	6.006"	7.271"	9.062"	10.748"	11.801"	13.487"	15.173"
	Weight lb/lf	---	---	---	---	0.531	1.153	1.906	2.718	2.912	4.130	4.779	7.001	10.875	15.298	18.445	24.092	30.491
DR 15.5 (110psi)	Min. wall	---	---	---	---	0.153"	0.226"	0.290"	0.347"	0.359"	0.427"	0.460"	0.556"	0.694"	0.823"	0.903"	1.032"	1.161"
	Average I.D.	---	---	---	---	2.050"	3.021"	3.885"	4.640"	4.802"	5.719"	6.150"	7.445"	9.280"	11.006"	12.085"	13.812"	15.538"
	Weight lb/lf	---	---	---	---	0.467	1.015	1.678	2.396	2.564	3.637	3.985	6.164	9.576	13.471	16.242	21.214	26.849
DR 17 (100psi)	Min. wall	---	---	---	---	0.140"	0.206"	0.265"	0.316"	0.327"	0.390"	0.419"	0.507"	0.632"	0.750"	0.824"	0.941"	1.059"
	Average I.D.	---	---	---	---	2.079"	3.064"	3.939"	4.705"	4.869"	5.799"	6.236"	7.549"	9.409"	11.160"	12.254"	14.005"	15.755"
	Weight lb/lf	---	---	---	---	0.429	0.932	1.540	2.197	2.353	3.338	3.860	5.657	8.788	12.362	14.905	19.467	24.638
DR 19 (89psi)	Min. wall	---	---	---	---	---	---	0.237"	0.283"	0.293"	0.349"	0.375"	0.454"	0.566"	0.671"	0.737"	0.842"	0.947"
	Average I.D.	---	---	---	---	---	---	3.998"	4.775"	4.942"	5.886"	6.330"	7.663"	9.551"	11.327"	12.438"	14.215"	15.992"
	Weight lb/lf	---	---	---	---	---	---	1.387	1.980	2.120	3.007	3.478	5.097	7.918	11.138	13.429	17.540	22.199
DR 21 (80psi)	Min. wall	---	---	---	---	---	---	0.214"	0.256"	0.265"	0.315"	0.339"	0.411"	0.512"	0.607"	0.667"	0.762"	0.857"
	Average I.D.	---	---	---	---	---	---	4.046"	4.832"	5.001"	5.956"	6.406"	7.754"	9.665"	11.463"	12.587"	14.385"	16.183"
	Weight lb/lf	---	---	---	---	---	---	1.262	1.801	1.929	2.736	3.165	4.637	7.204	10.134	12.218	15.959	20.198
DR 26 (64 psi)	Min. wall	---	---	---	---	---	---	0.173"	0.207"	0.214"	0.255"	0.274"	0.332"	0.413"	0.490"	0.538"	0.615"	0.692"
	Average I.D.	---	---	---	---	---	---	4.133"	4.937"	5.109"	6.085"	6.544"	7.922"	9.873"	11.710"	12.858"	14.695"	16.532"
	Weight lb/lf	---	---	---	---	---	---	1.030	1.470	1.574	2.233	2.582	3.784	5.878	8.269	9.970	13.022	16.480
DR 32.5 (51 psi)	Min. wall	---	---	---	---	---	---	0.138"	0.165"	0.171"	0.204"	0.219"	0.265"	0.331"	0.392"	0.431"	0.492"	0.554"
	Average I.D.	---	---	---	---	---	---	4.206"	5.024"	5.200"	6.193"	6.660"	8.062"	10.049"	11.918"	13.087"	14.956"	16.826"
	Weight lb/lf	---	---	---	---	---	---	0.831	1.186	1.270	1.801	2.083	3.053	4.742	6.671	8.044	10.506	13.296

HDPE Fabricated and Molded Fittings

Pressure Ratings for Molded and Fabricated Fittings

Fittings serve the purpose of creating a change in direction in a short distance. There are two basic types of fittings, molded and fabricated. Molded fittings are made by injection molding. These fittings are fully pressure rated. The body of a molded fitting is thicker (greater OD except at ends) than pipe to maintain the pressure rating.

Fabricated fittings have reduced pressure rating because miter cuts create a change in the diameter of the fitting at this point. Stress is increased because of changes in flow direction. The larger the angle of the miter cut, the greater the stress and the greater the need to decrease the pressure rating to maintain a 2 to 1 safety factor.

In this Fitting Section, mitered fittings are shown with traditional three-piece 45 degree and five-piece 90 degree ells. Newly added are two-piece 45 degree ells and three-piece 90 degree ells. To maintain a 2 to 1 safety factor, the two-piece 45 degree ells and the three-piece 90 degree ells have a lower pressure rating for the same wall thickness (DR) than do the three-piece 45 degree and five-piece 90 degree ells.

The pressure ratings are based on standards for design established by the American Society of Mechanical Engineers (ASME). These standards are in ASME B31.3 paragraph number 304.2. Equations 4a and 4b are used to determine pressure ratings.

For five-piece mitered 90 degree and three-piece 45 degree ells based on 22.5 degree miter joints, the derating factor is 25% of the pressure rating of the pipe. A DR 11 wall thickness has a pressure rating of 160 psi. Fittings made from DR 11 pipe have a pressure rating of 120 psi. The 25% derating factor is based on a 2 to 1 safety factor.

For three-piece mitered 90 degree and two-piece 45 degree ells based 45 degree miter cuts, the derating factor is 38%. Fittings made from DR 11 pipe have a pressure rating of 100 psi. The 38% derating factor is based on a 2 to 1 safety factor.

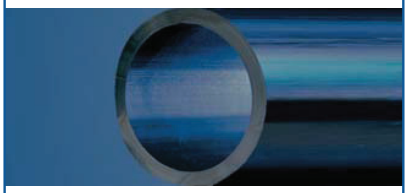
Derating factors for fittings are provided in Table 1, Derating Factors for HDPE Fittings. This table can assist in the selection of the correct fitting for a given application based on pressure rating requirements. Derating factor is the percentage that the pressure rating is lowered.

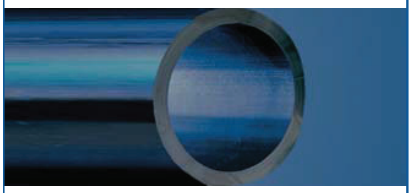
Table 1: Derating Factors For HDPE Fittings

Description	Industry Practice	Derating ASME B31.3
Fabricated 90 degree Ell - Five Segment	25%	25%
Fabricated 90 degree Ell Three	25%	38%
Fabricated 45 degree Ell Three	25%	25%
Fabricated 45 degree Ell Two	25%	38%
Fabricated 22.5 degree Ell Two	25%	25%
Fabricated Tees, Three Piece	25%	25%
Fabricated Tees, Two Piece	50%	25%
Fabricated Cross	50%	50%
Fabricated Wye, Three piece	40%	40%
Fabricated Wye, Two piece	50%	50%
Reducing Tee	none	none
Fabricated Cleanouts	***see note**	***see note**
Concentric Reducers	none	none
Transition Fittings	none	none
MJ Adapters	none	none
Bell MJ Adapters	none	none
Flange Adapters	none	none
Stub Ends	none	none
Molded Caps	none	none
Wall Anchors	none	none
Blind Flanges	***see note**	***see note**

Molded fittings such as 90 degree ells, 45 degree ells, tees, reducers, and end caps are normally not derated. These fittings have been designed and made with the needed radius and material in critical areas to handle the pressure for the thickness of the fitting. These fittings do not require derating when used at 73 degrees F with water or approved chemical service.

***NOTE: Plastic blind flanges are normally used for gravity or low pressure applications. Fabricated caps are typically designed to handle the required pressure. Blind Flanges and fabricated caps pressure ratings vary with size, type of material and thickness. Please indicate pressure requirements when ordering.**





HDPE Fabricated and Molded Fittings

ASME B 31.3 provides calculations to estimate derating factors for metal fittings. These values are applied to HDPE fittings in the table (refer to table 1). These ratings result in a 2 to 1 safety factor.

New three-piece miter 90 degree ells and two-piece 45 degree ells have been derated differently than ASME calculations by some HDPE fabricators. Using the BSME 31.3 method, its appears that the safety factor is less than 2 to 1.

ISCO Industries recognizes that these fittings are satisfactory for many applications using a lower derating factor and lower safety factor. This note has been provided to make you aware that critical applications may be better handled with five-piece mitered 90 degree ells. Critical applications are those that have high flow velocity (above 5 fps), higher temperature and those that may endanger people or the environment. Use good engineering judgment in the selection of fittings for your application.

Please call ISCO at 1-800-345-ISCO or go to our web site (www.isco-pipe.com) and use "Ask an Engineer" to answer your questions and get additional information.

TRANSITION FITTINGS

Transition fittings are mechanical connections between metal pipe and HDPE pipe. These fittings are used in a large number of applications. A common use is in natural gas systems to change from HDPE pipe to steel pipe where the pipe goes above ground.

Transition fittings for natural gas service are required to meet the requirements of ASTM D 2513, "Standard Specifications for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings". Within this specification there are provisions for mechanical joints. The specification indicates that the mechanical connection must: 1) provide a seal plus resistance to force on the pipe which will cause permanent deformation of the pipe, 2) provide a seal only, and 3) provide a seal plus a pipe restraint.

Not all transition fittings will meet the requirements of ASTM 2513. If you need transitions that meet ASTM 2513, ask for this requirement.

Central Plastics test their products using ASTM D 638 tensile test. This testing qualifies their fittings as providing a seal plus resistance to force which will cause permanent deformation.

Quick burst test per ASTM D1599 are used to proof that the transition fittings provide a seal and resist axial pullout forces.

Transition fittings are made from different metals. Carbon steel is the standard. If you need greater corrosion resistance, please request stainless steel transition fittings.

Carbon Steel Transition Fittings

Features:

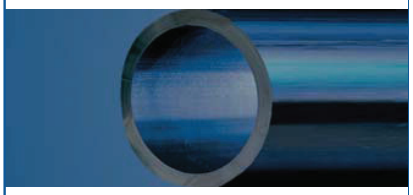
Compression design effectively resists creep and pullout
Carbon steel per ASTM A-53, Sch. 40 steel pipe
O-Ring design for added protection
Meets ASTM 2513
No Weld Design
Size range 3/4" through 12"
No shear points
Available with AWWA pipe

Stainless Steel Transition Fittings

Features:

Compression design effectively resists creep and pullout
Stainless Steel 304 Body (316 Available)
O-Ring design for added protection
Meets ASTM 2513
No Weld Design
Size range 3/4" through 2"
No shear points
Available with AWWA pipe

Threads per ANSI B1.20.1



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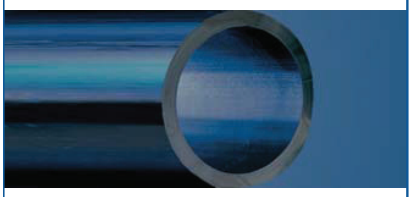
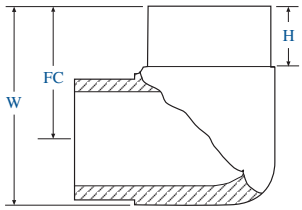


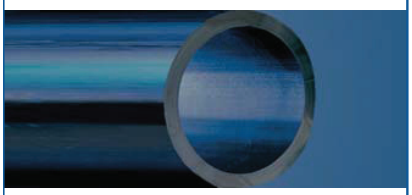
IPS
HDPE
Fittings

IPS Fittings Molded 90° Ell



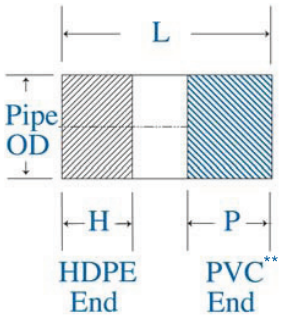
IPS Fittings Molded 90° Ell

Nominal Size(in)	Pipe OD(in)	DR	Pressure Rating	Part #	Dimensions H (in)	FC (in)	W (in)	Weight Lbs.	Shipping Method
3/4	1.05	11	160	ISMF9007511IPS	2.05	2.68	3.2	0.05	UPS
1	1.315	11	160	ISMF900111IPS	2.17	2.91	3.57	0.1	UPS
1-1/4	1.66	11	160	ISMF9012511IPS	2.44	3.35	4.18	0.15	UPS
1-1/2	1.9	11	160	ISMF901511IPS	2.64	3.7	4.65	0.22	UPS
2	2.375	09	200	ISMF900209IPS	2.5	4.25	5.815	0.5	UPS
		11	160	ISMF900211IPS	"	"	"	0.43	"
3	3.5	09	200	ISMF900309IPS	3	5.25	7.4	1.5	UPS
		11	160	ISMF900311IPS	"	"	"	1.2	"
		17	100	ISMF900317IPS	"	"	"	0.8	"
4	4.5	09	200	ISMF900409IPS	3	5.875	8.25	3	UPS
		11	160	ISMF900411IPS	"	"	"	2.4	"
		17	100	ISMF900417IPS	"	"	"	1.6	"
6	6.625	09	200	ISMF900609IPS	4.125	8	12.5	7	UPS
		11	160	ISMF900611IPS	"	"	"	6.7	"
		17	100	ISMF900617IPS	"	"	"	4.8	"
8	8.625	11	160	ISMF900811IPS	6	12	16.5	15	UPS
		17	100	ISMF900817IPS	"	"	"	10	"
10	10.75	11	160	ISMF901011IPS	6	13.25	18.875	27	UPS
		17	100	ISMF901017IPS	"	"	"	18	"
12	12.75	11	160	ISMF901211IPS	7.5	15.88	22.555	41	UPS
		17	100	ISMF901217IPS	"	"	"	27	"



IPS
HDPE
Fittings

IPS HDPE to PVC Transition Fitting



IPS HDPE To PVC Transition Fitting

Nominal Size (in)	Pipe OD (in)	Material	Part #	Dimensions H (in)	L (in)	P (in)	Weight Lbs.	Shipping Method
3/4	1.05	Steel Stainless Steel	ISFFTF003/4PVC ISFFTF003/4PVCS	3	8 “	3 “	0.7 “	UPS “
1	1.315	Steel Stainless Steel	SFFTF0111PVC ISFFTF0111PVCSS	3	8.5 “	3 “	0.8 “	UPS “
1 1/4	1.66	Steel Stainless Steel	ISFFTF01.25PVC ISFFTF01.25PVCS	4	11.5 “	4 “	1 “	UPS “
1 1/2	1.9	Steel Stainless Steel	ISFFTF01.5PVC ISFFTF01.50PVCS	4	12 “	4 “	1.25 “	UPS “
2	2.375	Steel Stainless Steel	ISFFTF0211PVC ISFFTF0211PVCSS	4	12.5 “	4 “	1.5 “	UPS “
3	3.5	Steel Stainless Steel	ISFFTF0311PVC ISFFTF0311PVCSS	4.5	14 “	4.5 “	3 “	UPS “
4	4.5	Steel Stainless Steel	ISFFTF0411PVC ISFFTF0411PVCSS	4.5	15 “	4.5 “	5 “	UPS “

** PVC available as SCH 40 or SCH 80.

DRISCOPIPE

FLEXIBILITY The flexibility of polyethylene pipe allows it to be curved over, under, and around obstacles as well as make elevation and directional changes. In some instances, the pipe's flexibility can eliminate the need for fittings and reduce installation costs.

Driscopipe HDPE pipe can be bent to a minimum radius between 20 to 40 times the pipe diameter.

TABLE 2: MINIMUM ALLOWABLE BEND RADIUS @ 73.4°F

SDR	Minimum Allowable Bend Radius, R_a
32.5	> 40 times outside diameter
26	> 35 times outside diameter
21	> 28 times outside diameter
19	> 27 times outside diameter
17	> 27 times outside diameter
15.5	> 27 times outside diameter
13.5	> 25 times outside diameter
11	> 25 times outside diameter
9	> 20 times outside diameter
7	> 20 times outside diameter

Example: Assume a 24" diameter DR 21 pipe was to be bent. The minimum bend radius can be calculated as follows:

$$R_a > 28 \times D \qquad R_a > 28 \times 24" \qquad R_a > 672"$$

Where: R_a is the radius of curvature of the bend in the pipe, in.
D is the outside diameter of the pipe, in.

The radius of the circular sector (bend) must be greater than 672" (56 ft).

FLOW FACTORS Driscopipe polyethylene pipe has a smooth inside surface. A "C" factor of 150 is recommended in the Hazen-Williams Formula. Polyethylene pipe has a recommended Manning's "n" value of 0.009. The smoothness factor, ε, is equal to 7×10^{-6} ft. Smooth walls and the non-wetting characteristic of polyethylene allow higher flow capacity and reduced friction loss with polyethylene pipe.

LIFE EXPECTANCY The hydrostatic design basis for Driscopipe pipe is based on extensive hydrostatic testing data evaluated by standardized industry methods. Based on ASTM D2837, regression curves project a life expectancy of approximately 50 years when transporting water at 73.4°F. Internal and external environmental conditions may alter the expected life or change the recommended design basis for a given application.

LIGHTWEIGHT Polyethylene pipe is much lighter than concrete, cast iron, or steel pipe. It is easier to handle and install. Reduced manpower and equipment requirements may result in installation savings.

PRESSURE RATINGS Phillips Driscopipe manufactures polyethylene pipe for gravity flow and pressure service through 267 psi at 73.4° F. Some applications or design codes require that the pipe be derated, resulting in lower design pressure ratings. The formulas used to design polyethylene piping systems include a 2:1 safety factor in hydrostatic stress and a greater than 2:1 safety factor in surge fatigue.

PVC White Schedule 40 Fittings, Unions, & Saddles

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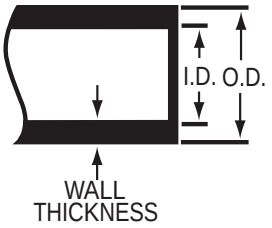
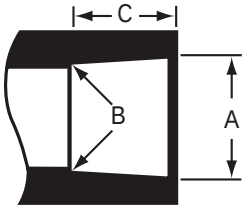
SCHEDULE 40 PIPE DIMENSIONS ASTM D 1785



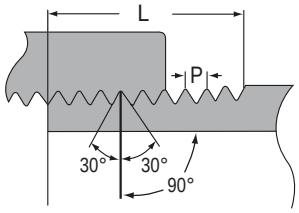
Nominal Pipe Size In.	Mean Outside Diameter In.	O. D. Tolerance In.	Minimum Wall Thickness In.
1/8	0.405	± 0.004	0.068
1/4	0.540	± 0.004	0.088
3/8	0.675	± 0.004	0.091
1/2	0.840	± 0.004	0.109
3/4	1.050	± 0.004	0.113
1	1.315	± 0.005	0.133
1-1/4	1.660	± 0.005	0.140
1-1/2	1.900	± 0.006	0.145
2	2.375	± 0.006	0.154
2-1/2	2.875	± 0.007	0.203
3	3.500	± 0.008	0.216
4	4.500	± 0.009	0.237
5	5.563	± 0.010	0.258
6	6.625	± 0.011	0.280
8	8.625	± 0.015	0.322
10	10.750	± 0.015	0.365
12	12.750	± 0.015	0.408

SCHEDULE 40 SOCKET DIMENSIONS ASTM D 2466



Nominal Size In.	Diameter			Socket Length Minimum C
	Entrance A	Bottom B	Tolerance A	
1/8	0.417	0.401	± 0.004	0.500
1/4	0.552	0.536	± 0.004	0.500
3/8	0.687	0.671	± 0.004	0.594
1/2	0.848	0.836	± 0.004	0.688
3/4	1.058	1.046	± 0.004	0.719
1	1.325	1.310	± 0.005	0.875
1-1/4	1.670	1.655	± 0.005	0.938
1-1/2	1.912	1.894	± 0.006	1.094
2	2.387	2.369	± 0.006	1.156
2-1/2	2.889	2.868	± 0.007	1.750
3	3.516	3.492	± 0.008	1.875
4	4.518	4.491	± 0.009	2.000
5	5.583	5.553	± 0.010	3.000
6	6.647	6.614	± 0.011	3.000
8	8.655	8.610	± 0.015	4.000
10	10.780	10.735	± 0.015	5.000
12	12.780	12.735	± 0.015	6.000

AMERICAN NATIONAL STANDARD TAPER PIPE THREADS (NPT) ANSI B1.20.1,ASTM F 1498



Nominal Size In.	Threads Per Inch.	Effective Thread Length L	Pitch Of Thread P
1/8	27	0.2639	0.03704
1/4	18	0.4018	0.05556
3/8	18	0.4078	0.05556
1/2	14	0.5337	0.07143
3/4	14	0.5457	0.07143
1	11-1/2	0.6828	0.08696
1-1/4	11-1/2	0.7068	0.08696
1-1/2	11-1/2	0.7235	0.08696
2	11-1/2	0.7565	0.08696
2-1/2	8	1.1375	0.12500
3	8	1.2000	0.12500
4	8	1.3000	0.12500
5	8	1.4063	0.12500
6	8	1.5125	0.12500
8	8	1.7125	0.12500

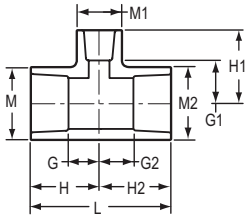
Molded Schedule 40 products are manufactured to ASTMD 2466 for use with pipe manufactured to ASTM D1785. Certain products carry reduced pressure handling capability and have maximum internal pressure ratings at 73° F noted.

Fabricated Schedule 40 pressure fittings (part numbers ending with "F") are manufactured to Spears® specifications for use with pipe manufactured to ASTM D1785. See publication FAB-7, General Specifications for Standard Fabricated Fittings for additional information.

All specified Schedule 40 products are manufactured from materials certified by NSF for use in potable water service.

REDUCING TEE **(continued)**

Socket x Socket x Socket



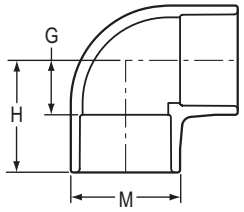
Part Number	Size	G	G1	G2	H	H1	H2	L	M	M1	M2	Approx. Wt. (Lbs.)
401-527[1]	6x6x1-1/2	1-3/8	3-7/8	1-3/8	4-27/32	5-3/16	4-27/32	9-11/16	7-1/4	2-11/16	7-1/4	3.60
401-528	6x6x2	1-3/8	3-19/32	1-3/8	4-27/32	4-31/32	4-27/32	9-11/16	7-3/16	2-11/16	7-3/16	3.39
401-529	6x6x2-1/2	2	3-15/16	2	5-1/2	5-15/16	5-1/2	10-15/16	7-3/16	3-15/16	7-3/16	4.29
401-530	6x6x3	2	3-23/32	2	5	5-19/32	5	10	7-1/4	4	7-1/4	3.89
401-532	6x6x4	2-17/32	3-5/8	2-17/32	6	5-5/8	6	12-1/16	7-3/16	5	7-3/16	4.54
401-533[1]	6x6x5	3-1/2	4-1/2	3-1/2	7	7-1/2	7	14	7-3/16	7-3/16	7-3/8	8.46
401-535[1]	6x6x8	5-3/8	5-1/2	5-3/8	8-7/8	9-1/2	8-7/8	17-3/4	9-1/2	9-3/4	9-1/2	19.21
401-537[1]	6x6x10	8	5-13/16	8	11-3/8	10-13/16	11-3/8	22-3/4	11-1/2	11-9/16	11-1/2	38.30
401-578[1]	8x8x2	2	5-7/8	2	6	7	6	12	9-1/4	4	9-1/4	11.71
401-579[1]	8x8x2-1/2	2	5-5/16	2	6	7-5/16	6	12	9-5/16	4	9-5/16	6.62
401-580	8x8x3	1-31/32	4-3/4	1-31/32	6-1/32	6-3/4	6-1/32	12-1/16	9-11/32	4	9-11/32	6.44
401-582	8x8x4	2-17/32	4-11/16	2-17/32	6-17/32	6-11/16	6-17/32	13-1/16	9-9/32	4-31/32	9-9/32	7.02
401-583[1]	8x8x5	3-21/32	5-1/4	3-21/32	7-21/32	8-1/4	7-21/32	15-5/16	9-5/16	7-1/4	9-5/16	10.60
401-585	8x8x6	3-5/8	4-3/4	3-5/8	7-21/32	7-25/32	7-21/32	15-11/32	9-11/32	7-1/4	9-11/32	8.90
401-589[1]	8x8x10	6-23/32	5-11/16	6-23/32	11-7/32	10-1/2	11-7/32	22-7/16	11-9/16	11-9/16	11-9/16	34.76
401-621F	10x10x2	4-7/8	7-1/4	4-7/8	10-1/8	9	10-1/8	20-1/4	11-1/2	2-11/16	11-1/2	19.60
401-623[1]	10x10x3	3-13/16	7	3-13/16	9-3/8	9	9-3/8	18-3/4	12	7-1/2	12	25.54
401-624[1]	10x10x4	3-27/32	7-3/8	3-27/32	9-11/32	9-3/8	9-11/32	18-11/16	12	7-1/2	12	25.63
401-628[1]	10x10x8	5-3/4	7-3/16	5-3/4	10-7/8	11-1/4	10-7/8	21-11/16	11-11/16	11-11/16	11-1/2	29.85
401-661F	12x12x2	5-1/4	8-1/4	5-1/4	11-1/2	10	11-1/2	23	13-1/2	2-11/16	13-1/2	25.00
401-663F	12x12x3	5-3/4	9	5-3/4	12	11-1/4	12	23	13-1/2	3-15/16	13-1/2	31.41
401-664F	12x12x4	7	9-5/16	7	13-1/4	11-9/16	13-1/4	26-1/2	13-9/16	5	13-9/16	32.40
401-666[1]	12x12x6	4-7/8	8-5/16	4-7/8	11-7/16	11-3/4	11-7/16	22-13/16	14-1/4	9-3/4	14-1/4	44.02
401-668	12x12x8	4-27/32	7-1/8	4-27/32	11-13/32	11-1/8	11-13/32	22-13/16	14-1/4	9-3/4	14-1/4	40.00
401-670	12x12x10	6-13/16	7-3/8	6-13/16	12-13/16	13-1/4	12-13/16	25-5/8	13-3/4	13-3/4	13-3/4	50.00
401-670F	12x12x10	10-1/4	10-3/8	10-1/4	16-1/2	15-5/8	16-1/2	33	13-9/16	11-1/2	13-9/16	50.00
401-676F	12x12x16	18-1/2	12-3/4	18-1/2	30-1/4	20-3/4	30-1/4	60-1/2	14-1/8	17	14-1/8	144.87
401-678F	12x12x18	14-1/4	13	17-7/8	23-1/4	22	23-7/8	47-3/4	19-1/8	19-1/8	19-1/8	252.00
401-691F	14x14x2	6	9-1/4	6	13	11	13	26	14-7/8	2-3/4	14-7/8	35.53
401-693F	14x14x3	6-1/2	9-9/16	6-1/2	13-1/2	11-13/16	13-1/2	27	14-7/8	3-15/16	14-7/8	38.35
401-694F	14x14x4	7-1/2	10	7-1/2	14-1/2	12-1/4	14-1/2	29	14-7/8	5	14-7/8	38.58
401-696F	14x14x6	8	10-1/4	8	15	13-1/2	15	30	14-7/8	7-1/8	14-7/8	45.70
401-698F	14x14x8	9-1/8	10-1/2	9-3/32	16-1/8	14-3/4	16-3/32	32-3/16	14-7/8	9-3/8	14-7/8	51.99

[1] Oultet sized with bushing

PVC WHITE SCHEDULE 40 FITTINGS
UNIONS & SADDLES

90° ELBOW

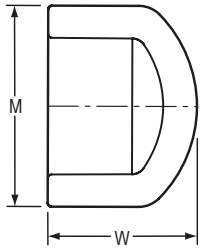
Socket x Socket



Part Number	Size	G	H	M	Approx. Wt. (Lbs.)
406-003	3/8	3/8	1-1/8	7/8	.03
406-005	1/2	1/2	1-1/4	1-1/16	.05
406-007	3/4	9/16	1-1/2	1-5/16	.07
406-010	1	11/16	1-13/16	1-5/8	.12
406-012	1-1/4	31/32	2-5/32	2	.20
406-015	1-1/2	1-1/16	2-3/8	2-7/32	.25
406-020	2	1-9/32	2-21/32	2-3/4	.37
406-025	2-1/2	1-15/16	3-7/32	3-5/16	.71
406-030	3	1-7/8	3-25/32	3-31/32	1.04
406-040	4	2-1/2	4-1/2	5	1.71
406-045F	4-1/2	7-1/8	9-5/8	5-1/2	3.13
406-050	5	3-1/16	6-1/8	6-5/32	3.58
406-060	6	3-1/2	6-29/32	7-9/32	5.03
406-080	8	4-7/16	8-15/32	9-5/16	8.75
406-100	10	5-29/32	10-7/8	11-5/8	17.82
406-100F	10	9-1/2	14-3/4	11-1/2	17.40
406-120	12	7-1/16	13-9/16	14-1/4	27.98
406-120F	12	10-1/2	16-3/4	13-9/16	25.94
406-140F	14	12-1/4	19-1/4	14-7/8	47.26
406-160F	16	14-1/8	22-1/8	17	69.70
406-180F	18	17-1/4	26-1/4	19-1/8	104.20
406-200F	20	18-3/4	28-3/4	21-3/16	131.93
406-240F	24	22-1/4	34-1/4	25-3/8	216.00

PVC WHITE SCHEDULE 40 FITTINGS
UNIONS & SADDLES

CAP
Socket



Part Number	Size	M	W	Approx. Wt. (Lbs.)
447-003	3/8	7/8	1	.01
447-005	1/2	1-3/32	1-1/32	.02
447-007	3/4	1-5/16	1-5/16	.04
447-010	1	1-9/16	1-9/16	.06
447-012	1-1/4	1-31/32	1-3/4	.09
447-015	1-1/2	2-1/4	1-7/8	.11
447-020	2	2-23/32	2-1/32	.17
447-025	2-1/2	3-5/16	2-9/16	.33
447-030	3	4	2-29/32	.49
447-040	4	5-1/16	3-1/8	.85
447-045F	4-1/2	5-1/4	3-1/4	.31
447-050	5	6-5/32	4-1/2	1.43
447-060	6	7-1/4	5	2.36
447-080	8	9-5/16	6-3/8	4.35
447-100F	10	11-13/16	5-1/4	5.22
447-120F	12	13-7/8	6-3/4	8.22
447-140F	14	15	7-3/8	8.75
447-160F	16	17	9	12.15
447-180F	18	19-1/16	9	17.58
447-200F	20	21-3/16	12-1/4	26.48
447-240F	24	25-1/2	13-1/2	40.26

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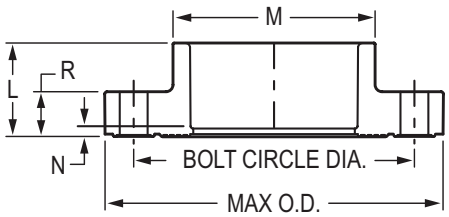
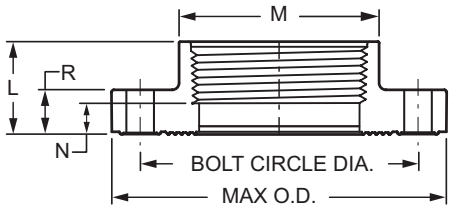
F O P
Socket



P N		S		M	N	R	C	N	S	M	M O	A	
P C	CP C											P C	CP C
851-005	851-005C	1/2	1-1/16	1-9/32	1/8	9/16	2-3/8	4	1/2	2	3-1/2	.22	.24
851-007	851-007C	3/4	1-3/16	1-1/2	1/8	5/8	2-3/4	4	1/2	2	3-7/8	.31	.31
851-010	851-010C	1	1-5/16	1-13/16	3/16	3/4	3-1/8	4	1/2	2-1/4	4-1/4	.44	.47
851-012	851-012C	1-1/4	1-7/16	2-7/32	3/16	23/32	3-1/2	4	1/2	2-1/4	4-5/8	.41	.42
851-015	851-015C	1-1/2	1-23/32	2-1/2	1/4	3/4	3-7/8	4	1/2	2-1/2	5	.61	.64
851-020	851-020C	2	1-27/32	3	3/8	13/16	4-3/4	4	5/8	3	6	.82	.95
851-025	851-025C	2-1/2	2-1/4	3-1/2	1/2	1	5-1/2	4	5/8	3-1/4	7	1.63	1.67
851-030	851-030C	3	2-5/16	4-9/32	15/32	1-1/16	6	4	5/8	3-1/4	7-1/2	1.73	1.83
851-040	851-040C	4	2-5/8	5-7/16	1/4	1-1/4	7-1/2	8	5/8	3-1/2	9	2.88	3.00
851-050	851-050C	5	3-1/4	6-3/8	1/4	1	8-1/2	8	3/4	3-3/4	10-1/8	3.00	3.17
851-060	851-060C	6	3-1/4	7-9/16	1/4	1-3/8	9-1/2	8	3/4	4	11	4.06	4.34
851-080	851-080C	8	4-9/16	9-3/4	9/16	1-7/16	11-3/4	8	3/4	4-1/2	13-1/2	7.63	7.36

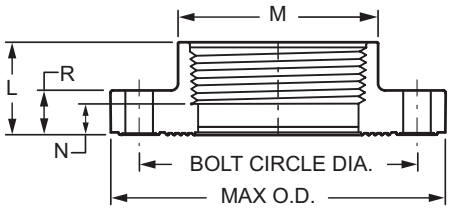
F O P
Fipt



P N		S		M	N	R	C	N	S	M	M O	A	
P C	CP C											P C	CP C
852-005	852-005C	1/2	1-1/16	1-5/16	9/32	9/16	2-3/8	4	1/2	2	3-1/2	.21	.22
852-007	852-007C	3/4	1-3/16	1-17/32	15/32	5/8	2-3/4	4	1/2	2	3-7/8	.30	.32
852-010	852-010C	1	1-5/16	1-13/16	7/16	3/4	3-1/8	4	1/2	2-1/4	4-1/4	.41	.48
852-012	852-012C	1-1/4	1-3/8	2-7/32	17/32	23/32	3-1/2	4	1/2	2-1/4	4-5/8	.44	.46
852-015	852-015C	1-1/2	1-3/4	2-1/2	19/32	3/4	3-7/8	4	1/2	2-1/2	5	.64	.74

F O P **(continued)**

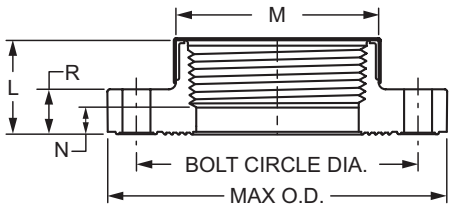
Fipt



P N		S		M	N	R	C	N	S	M	M O	A	
P C	CP C											P C	CP C
852-020	852-020C	2	1-27/32	3	7/8	7/8	4-3/4	4	5/8	3	6	.96	1.00
852-025	852-025C	2-1/2	2-1/4	3-1/2	15/16	1	5-1/2	4	5/8	3-1/4	7	1.65	1.41
852-030	852-030C	3	2-5/16	4-9/32	29/32	1-1/16	6	4	5/8	3-1/4	7-1/2	1.83	1.86
852-040	852-040C	4	2-1/16	5-7/16	5/16	1-1/4	7-1/2	8	5/8	3-1/2	9	2.79	2.86
852-060F	852-060CF	6	7	7-1/4	5-1/2	1-1/4	9-1/2	8	3/4	4	11	7.16	7.69
852-080F	852-080CF	8	8-15/16	9-11/16	7-3/16	1-3/8	11-3/4	8	3/4	4-1/2	13-1/2	13.41	13.92
852-100F	852-100CF	10	10-1/2	11-9/16	8-9/16	1-11/16	14-1/4	12	7/8	5	16	20.65	20.72

S R F O P

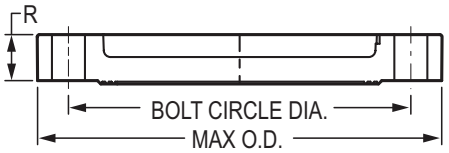
SR Fipt



P N		S		M	N	R	C	N	S	M	M O	A	
P C	CP C											P C	CP C
852-005SR	852-005CSR	1/2	1-3/32	1-7/32	11/32	9/16	2-3/8	4	1/2	2	3-1/2	.20	.22
852-007SR	852-007CSR	3/4	1-3/16	1-3/8	7/16	5/8	2-3/4	4	1/2	2	3-7/8	.27	.30
852-010SR	852-010CSR	1	1-7/16	1-23/32	17/32	21/32	3-1/8	4	1/2	2-1/4	4-1/4	.37	.39
852-012SR	852-012CSR	1-1/4	1-9/16	2-1/16	19/32	21/32	3-1/2	4	1/2	2-1/4	4-5/8	.49	.52
852-015SR	852-015CSR	1-1/2	1-3/4	2-7/16	3/4	3/4	3-7/8	4	1/2	2-1/2	5	.63	.67
852-020SR	852-020CSR	2	1-7/8	3-1/32	7/8	11/16	4-3/4	4	5/8	3	6	.99	1.06
852-025SR	852-025CSR	2-1/2	2-1/8	3-19/32	3/8	1	5-1/2	4	5/8	3-1/4	7	1.58	1.69
852-030SR	852-030CSR	3	2-5/16	4-9/32	15/16	1-1/16	6	4	5/8	3-1/4	7-1/2	1.79	1.94
852-040SR	852-040CSR	4	2-1/2	5-1/4	1	1-5/32	7-1/2	8	5/8	3-1/2	9	2.74	2.89

PVC & CPVC INJECTION MOLDED CLASS 150 FLANGES

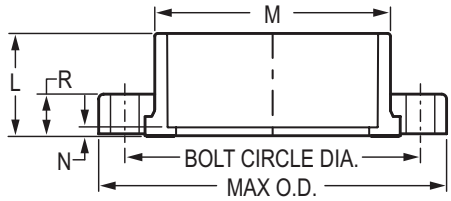
IN F ANGE



P N		S	R	C	N	S	M	M O	A	
P C	CP C								P C	CP C
853-005	853-005C	1/2	9/16	2-3/8	4	1/2	2	3-1/2	.21	.21
853-007	853-007C	3/4	5/8	2-3/4	4	1/2	2	3-7/8	.28	.30
853-010	853-010C	1	3/4	3-1/8	4	1/2	2-1/4	4-1/4	.41	.47
853-012	853-012C	1-1/4	23/32	3-1/2	4	1/2	2-1/4	4-5/8	.37	.40
853-015	853-015C	1-1/2	3/4	3-7/8	4	1/2	2-1/2	5	.62	.64
853-020	853-020C	2	13/16	4-3/4	4	5/8	3	5-15/16	.83	.88
853-025	853-025C	2-1/2	1	5-1/2	4	5/8	3-1/4	7	1.61	1.63
853-030	853-030C	3	1-1/16	6	4	5/8	3-1/4	7-5/8	1.56	1.64
853-040	853-040C	4	1-1/4	7-1/2	8	5/8	3-1/2	9	2.84	2.98
853-060	853-060C	6	1-3/8	9-1/2	8	3/4	4	11	4.36	4.45
853-080	853-080C	8	1-7/16	11-3/4	8	3/4	4-1/2	13-1/2	6.83	7.20
853-100	853-100C	10	1-11/16	14-1/4	12	7/8	5	16	11.32	11.80
853-120	853-120C	12	1-11/16	17	12	7/8	5	19	15.49	17.58

F S S

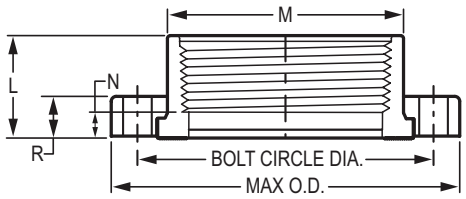
(Two Piece)
Socket



P N		S		M	N	R	C	N	S	M	M O	A	
P C	CP C											P C	CP C
854-005	854-005C	1/2	1-1/32	1-7/32	5/32	17/32	2-3/8	4	1/2	2	3-1/2	.19	.20
854-007	854-007C	3/4	1-1/8	1-7/16	5/32	9/16	2-3/4	4	1/2	2	3-7/8	.26	.27
854-010	854-010C	1	1-9/32	1-3/4	5/32	5/8	3-1/8	4	1/2	2-1/4	4-1/4	.36	.37
854-012	854-012C	1-1/4	1-13/32	2-5/32	5/32	11/16	3-1/2	4	1/2	2-1/4	4-5/8	.46	.45
854-015	854-015C	1-1/2	1-17/32	2-7/16	3/16	3/4	3-7/8	4	1/2	2-1/2	5	.56	.60
854-020	854-020C	2	1-11/16	2-15/16	3/16	13/16	4-3/4	4	5/8	3	6	.85	.91

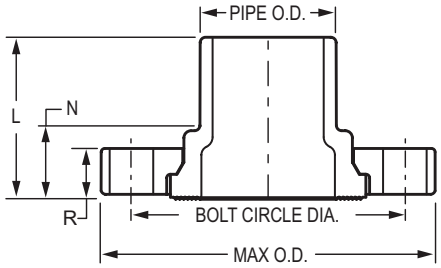
PVC & CPVC INJECTION MOLDED CLASS 150 FLANGES

F S S
(Two Piece)
Fipt



P N		S		M	N	R	C	N	S	M	M O	A	
P C	CP C											P C	CP C
855-005	855-005C	1/2	1-1/32	1-7/32	9/32	17/32	2-3/8	4	1/2	2	3-1/2	.19	.20
855-007	855-007C	3/4	1-5/32	1-3/8	13/32	9/16	2-3/4	4	1/2	2	3-7/8	.27	.28
855-010	855-010C	1	1-1/4	1-3/4	5/16	5/8	3-1/8	4	1/2	2-1/4	4-1/4	.36	.39
855-012	855-012C	1-1/4	1-3/8	2-1/8	13/32	11/16	3-1/2	4	1/2	2-1/4	4-5/8	.46	.47
855-015	855-015C	1-1/2	1-15/32	2-7/16	13/32	3/4	3-7/8	4	1/2	2-1/2	5	.55	.61
855-020	855-020C	2	1-9/16	2-31/32	1/2	13/16	4-3/4	4	5/8	3	6	.87	.94
855-025	855-025C	2-1/2	2	3-9/16	7/16	1	5-1/2	4	5/8	3-1/4	7	1.22	1.50
855-030	855-030C	3	2-1/8	4-1/4	1/2	1-1/16	6	4	5/8	3-1/4	7-1/2	1.73	1.79
855-040	855-040C	4	2-1/16	5-1/4	3/8	1-1/4	7-1/2	8	5/8	3-1/2	9	2.61	2.78
855-060F	855-060CF	6	7	7-1/4	5-1/2	1-1/4	9-1/2	8	3/4	4	11	7.62	7.69
855-080F	855-080CF	8	8-15/16	9-11/16	7-3/16	1-3/8	11-3/4	8	3/4	4-1/2	13-1/2	12.84	13.92
855-100F	855-100CF	10	10-1/2	11-9/16	8-9/16	1-11/16	14-1/4	12	7/8	5	16	20.65	20.72

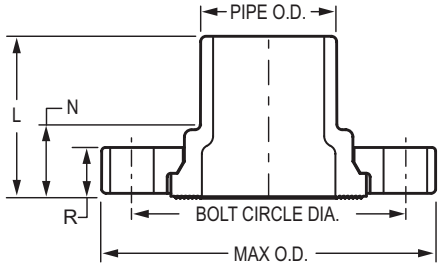
F S S
(Two Piece)
Spigot



P N		S		N	R	C	N	S	M	M O	A	
P C	CP C										P C	CP C
856-005	856-005C	1/2	1-3/4	29/32	17/32	2-3/8	4	1/2	2	3-1/2	.20	.21
856-007	856-007C	3/4	1-15/16	31/32	9/16	2-3/4	4	1/2	2	3-7/8	.29	.30
856-010	856-010C	1	2-3/16	1-1/32	5/8	3-1/8	4	1/2	2-1/4	4-1/4	.39	.41
856-012	856-012C	1-1/4	2-11/32	1-3/32	11/16	3-1/2	4	1/2	2-1/4	4-5/8	.50	.50

F S S (continued)

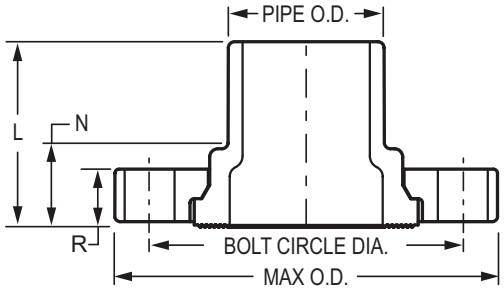
(Two Piece)
Spigot



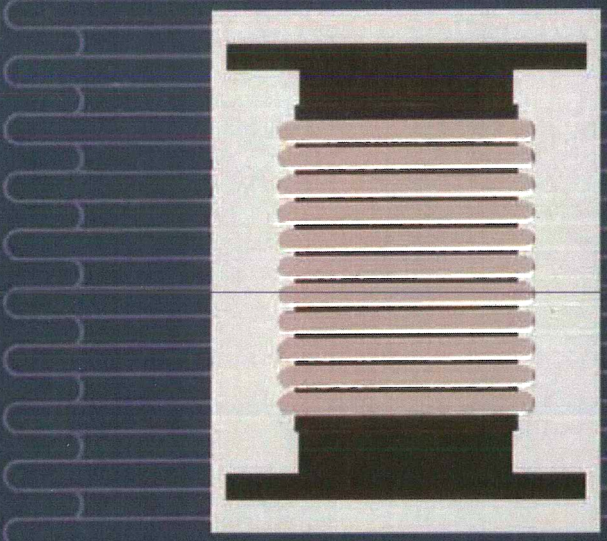
P N		S		N	R	C	N	S	M	M O	A	
P C	CP C										P C	CP C
856-015	856-015C	1-1/2	2-5/8	1-9/32	3/4	3-7/8	4	1/2	2-1/2	5	.60	.65
856-020	856-020C	2	2-7/8	1-11/32	13/16	4-3/4	4	5/8	3	6	.94	1.00
856-025	856-025C	2-1/2	3-1/16	1-9/32	1	5-1/2	4	5/8	3-1/4	7	1.29	1.54
856-030	856-030C	3	3-3/8	1-7/16	1-1/16	6	4	5/8	3-1/4	7-1/2	1.82	1.88
856-040	856-040C	4	3-7/8	1-5/8	1-1/4	7-1/2	8	5/8	3-1/2	9	2.93	3.12
856-060	856-060C	6	4-3/4	1-25/32	1-9/32	9-1/2	8	3/4	4	11	4.62	4.79
856-080	856-080C	8	5-7/8	1-15/16	1-3/8	11-3/4	8	3/4	4-1/2	13-1/2	7.95	8.17
856-100	856-100C	10	8	2-1/4	1-5/8	14-1/4	12	7/8	5	16	15.61	16.09
856-120	856-120C	12	8-1/2	2-3/16	1-5/8	17	12	7/8	5	19	21.31	22.70

F S S

with Multi-Bolt Pattern Ring
(Two Piece)
Spigot



P N		S		N	R	C		N	S	M O	A	
P C	CP C					M	M				P C	CP C
M856-020	M856-020C	2	2-7/8	1-11/32	13/16	4-1/2	4-15/16	4	5/8	6	.94	1.00
M856-030	M856-030C	3	3-3/8	1-7/16	1-1/16	5-13/16	6-11/32	8	5/8	7-1/2	1.82	1.96
M856-040	M856-040C	4	3-7/8	1-5/8	1-1/4	7-3/32	7-1/2	8	5/8	9	2.98	3.24
M856-060	M856-060C	6	4-3/4	1-25/32	1-9/32	9-7/32	9-1/2	8	3/4	11	4.77	5.21
M856-080	M856-080C	8	5-7/8	1-15/16	1-3/8	11-1/2	11-3/4	8	3/4	13-1/2	7.95	8.32



DME

METAL EXPANSION JOINTS

CONTENTS

Serving Customers since 1974
With Quality Products at
Competitive Prices

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This catalog presents the basic styles and construction of D.M.E. Expansion Joints for Piping and Ducting Systems. Materials are carefully selected for their specific application. Manufacturing is performed in a modern facility using techniques that produce the greatest economy and maximum performance.

Rigid quality control and testing assure customers that D.M.E. Expansion Joints will meet their most stringent application requirements. These factors, plus a wide range of expansion joint configurations, both catalog and special, provide customers with products outstanding in value, performance and reliability; reflecting the technical skills, craftsmanship and dedicated purpose that guarantee consistently high quality products.

D.M.E. has the experience, engineering knowledge and production capability to design and fabricate expansion joints to meet specific requirements. Our engineering staff will help solve any special or critical expansion joint application problem.

The manufacturing techniques at D.M.E. have been designed to promote the utmost in service. Each and every order is processed and expedited individually to provide rapid response to the customers' needs.

Each employee is committed to providing incomparable service and quality products

EXPANSION JOINT SELECTION GUIDE

The proper selection and application of an expansion joint is the determining factor in its operation and life. Improper selection and application will lead to problems in the field causing down time and system problems.

When selecting an expansion joint, these important factors should be considered:

- Pipe or line size.
- Maximum working pressure.
- Maximum temperature
- Type of movement (axial, lateral, angular, or a combination of movements).
- Amount of movement.
- Rate of media flow or velocity through the expansion joint.
- Type of media flowing through the expansion joint (steam, water, corrosives, etc.).
- Type of end fittings (flanges, weld ends, or special fittings.
- Extreme service conditions (vibration, large amounts of motion in more than one plane, etc.).

Experience has shown that if these basic factors are considered in the selection and specification stage, expansion joints perform as designed with minimal system problems.

EXPANSION JOINT TERMINOLOGY

There will be applications that may require the use of an expansion joint that is not shown in this catalog. A quick phone call or fax to D.M.E. and engineering or technical help will be available to resolve the expansion joint selection. To help in the selection process we've included some expansion joint terminology.

ANGULAR – The displacement of the longitudinal axis of the expansion joint from its straight line position into a circular arc.

AXIAL COMPRESSION OR EXTENSION – The dimensional shortening or lengthening of an expansion joint. Axial compression or extension has been referred as axial movement, traverse, compression, etc.

BELLOWS – The flexible element of an expansion joint, consisting of one or more corrugations (convolutions) may be single or multi-ply constructions.

COMBINED MOVEMENTS – Axial, lateral or angular movements that occur at the same time.

CONTROL RODS - Rods or bars that limit the travel of individual bellows in a universal tied expansion joint or in a dual bellows unit where each bellows takes a special motion. Control rods like limit rods can be designed to take full pressure thrust loads as well as loads imposed by the weight of the expansion joint. Control rods can be used to support loads external to the expansion joint but must be carefully specified. Not designed to absorb pressure thrust.

CYCLE - One complete movement of an expansion joint from initial to extreme position and return.

CYCLE LIFE - Total number of cycles an expansion joint will absorb at rated movement.

DEFLECTION FORCE - Amount of force required to cause movement in an expansion joint.

INTERNAL SLEEVE (LINER) - A device which minimizes contact between the inner surface of the bellows of an expansion joint and the fluid flowing through it.

LATERAL DEFLECTION - The relative displacement of the two ends of an expansion joint perpendicular to its longitudinal axis. Sometimes referred to as lateral offset, or shear.

LIMIT RODS - Rods or bars that limit the travel of the expansion joint. These are different from tie rods in that they are not usually designed to contain full press thrust forces generated by the expansion joint. In case of anchor failure they are designed to absorb pressure thrust loading.

MAXIMUM WORKING PRESSURE - Greatest pressure allowed on the expansion joint during operation.

MAXIMUM TEST PRESSURE - Highest permissible pressure which an expansion joint can be subjected without causing objectionable deformation of the bellows element.

MOVEMENT - The dimensional changes which an expansion joint is required to absorb, such as those resulting from thermal expansion or contraction.

PIPE ALIGNMENT GUIDE - Device used to guide, not support, the pipe as it moves due to thermal expansion or cotraction.

PIPE ANCHOR - Device used to firmly fix the location of a point in the piping system. No movement should occur at anchor point.

RATED MOVEMENT - Maximum amount of movement (axial compression, lateral deflection, angular rotation, or any combination thereof) which an expansion joint is capable of absorbing.

SHIPPING RODS (BARS) - Temporary supporting members attached to an expansion joint to prevent movement of the joint and retain dimensional stability during shipping, handling and installation.

SPRING RATE - Force required to compress, extended, laterally deflected, or angularly deflected an expansion joint one inch.

THRUST AREA - Area over which the effects of pressure in an expansion joint will produce a longitudinal force in the piping system.

TIE RODS - Rods or bars for the purpose of restraining the expansion joint from the thrust forces due to internal pressure on the expansion joint.

TORSION - The rotation of one end of the expansion joint relative to the opposite end of the expansion joint. Commonly referred to as torquing the expansion joint. This is not a recommended expansion joint application.

EXPANSION JOINT OPTIONAL ACCESSORIES

Liners or Internal Sleeves

A straight tube liner or internal sleeve should be provided in an expansion joint when high velocities are encountered and where it is desirable to reduce the temperature the bellows element is subjected to.

For steam, air, and gas line application, liners are recommended where the flow velocity exceeds 240 F.P.M. per inch of diameter up to 6" size and where the flow velocity exceeds 1500 F.P.M. in larger than 6" line sizes.

In water and liquid lines, liners are recommended where flow velocity exceeds 120 F.P.M. per inch of diameter up to 6" I.P.S. and where velocity exceeds 600 F.P.M. in larger than 6" I.P.S.

Liners should not be used for high viscosity fluids such as tars which can " pack-up" or "cake", and prevent drainage between the bellows element and liner causing premature failure of the bellows element of the expansion joint. When the fluid is such that purging would prevent "packing-up", purge ports may be used between bellows and liners.

Where lateral deflection or angular rotation is present, a liner with a smaller diameter must be provided to allow clearance between bellows I.D. and liner O.D.

Limit Rods

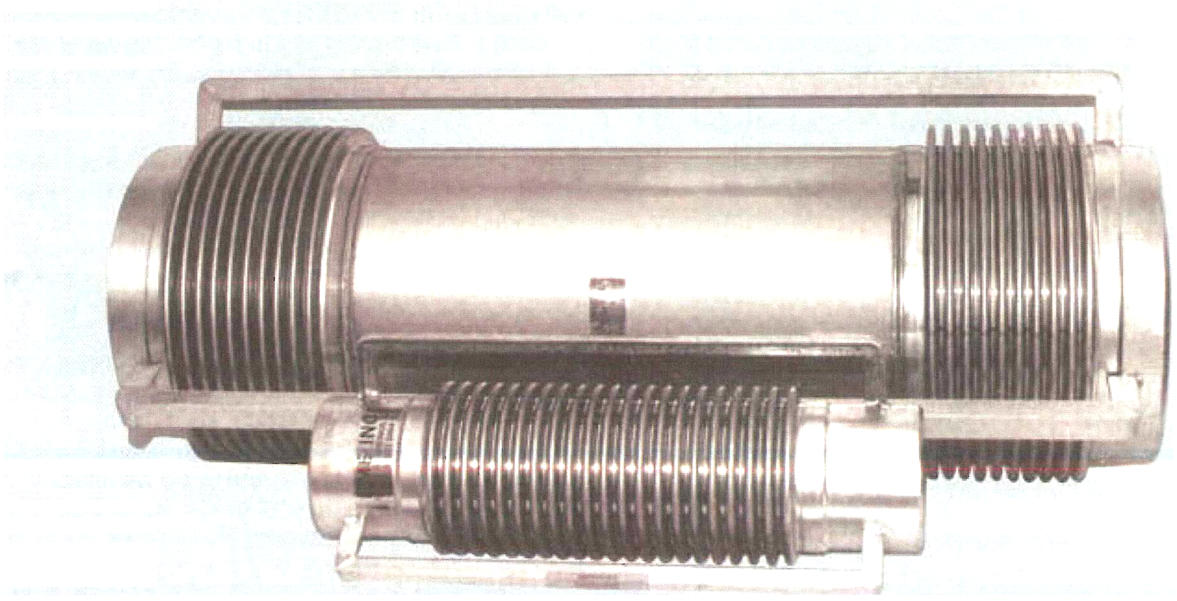
Limit rods are external devices that have stops to limit the amount of movement that an expansion joint is required to absorb, or to distribute the movement between several parts of the expansion joint. Limit rods may also be designed to support the weight of adjacent piping. Limit rods are designed to absorb full pressure thrust loading of the expansion joint and in case of anchor failure the dynamic forces generated.

Tie Rods

Tie rods are devices that are secured to the extreme ends of an expansion joint and are designed to constrain the full pressure thrust loads of an expansion joints.

Shrouds

Shrouds are external covers of sheet metal furnished to protect the exterior surfaces off the bellows element in an expansion joint from mechanical damage. Shrouds are also required where external insulation is to be placed over the expansion joint.



SERIES 250 LOW PRESSURE EXPANSION JOINTS

The Series 250 Low Pressure Expansion Joint was designed for applications where the weight off the expansion joint in the system is a consideration. Although light in weight, the Series 250 is strong in dependability.

Especially suited for application in low pressure, high temperature thin wall ducting systems. Typical applications are diesel exhaust piping, gas turbine exhaust, steam exhaust and forced air ducting.

The lightweight design of Series 250 Expansion Joints is achieved by using lightweight carbon steel plate flanges. Weld end configurations use standard weight wall thickness pipe through 12" size and .250" thick wall 14" through 48".

The bellows element is manufactured from stainless steel, engineered to contain the pressure, temperature and motion requirements.

Series 250 Low Pressure Expansion Joints are available in vanstone configuration to isolate the media from the carbon steel flanges. Vanstone flanges also allow flanges to be rotated for bolt hole alignment in field installations where this might be a problem. Stainless steel flow liners can be provided as an option when flows are turbulent.

Standard units have 321 stainless steel bellows elements and bellows extensions to flange. Weld ends are carbon steel. Flange drilling conforms to ANSI B16.5 Class 150.

Small amounts of lateral deflection are provided for in the design of Series 250 Expansion Joints but high cyclic lateral deflection is not recommended. (Dual Bellows Expansion Joints are recommended for high cyclic lateral deflection.)

The catalog lists sizes 4" I.P.S. through 48" I.P.S. as standard items. 1-1/2" through 96" sizes are available. Consult factory concerning Series 250 Expansion Joints over 48" I.P.S. diameter.

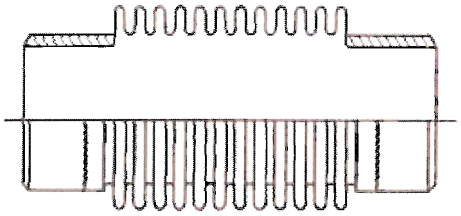
ORDERING AND SPECIFYING INSTRUCTIONS

Example: 14" I.P.S., Fixed Flange, 3.0" Axial Compression

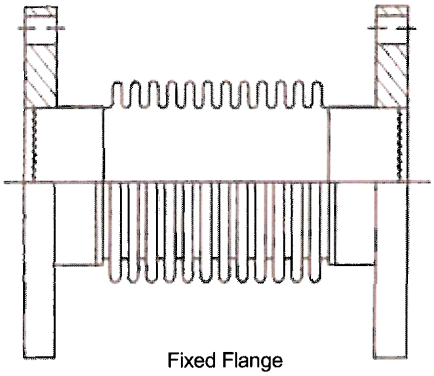
Part Number 25 - 5 - 14 - 30

- Series
- Fixed Flange
- 14" I.P.S. Size
- 3.0" Axial Compression

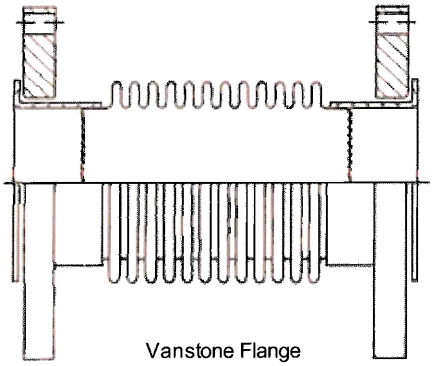
Note: Optional materials are available for severe corrosion applications. Series 250 can be supplied with angle iron and marmon type flanges as an option



Weld End
No. 254



Fixed Flange
No. 255



Vanstone Flange
No. 256

SERIES 250 SINGLE PLY LOW PRESSURE EXPANSION JOINTS

50 P.S.I. WORKING PRESSURE 75 P.S.I. TEST PRESSURE

Nominal Size (ips)	Size Designation	Axial Compression (inches)	Axial Extension (inches)	Lateral Offset from C/L (inches)	Axial Spring Rate (lbs/inch)	Overall Length (inches) (254) (255) (256)	Weight Approx. (lbs) (255) (256)	(254)
4	4	1.0 2.0 2.5 3.0	0.5 1.0 1.3 1.5	0.25 0.40 0.50 0.75	258 294 519 617	7.0 11.0 14.0 16.0	19 21 22 23	4 6 8 9
5	5	1.0 2.0 2.5 3.0	0.5 1.0 1.3 1.5	0.25 0.40 0.50 0.75	193 391 560 509	7.0 11.0 14.0 16.0	22 24 25 27	6 8 10 12
6	6	1.0 2.0 2.5 3.0	0.5 1.0 1.3 1.5	0.25 0.40 0.50 0.75	351 459 362 578	7.0 11.0 14.0 16.0	25 27 28 30	7 10 13 15
8	8	1.0 2.0 2.5 3.0	0.5 1.0 1.3 1.5	0.20 0.35 0.45 0.70	286 410 469 685	7.0 11.0 14.0 16.0	36 38 40 42	11 13 18 20
10	10	1.0 2.0 2.5 3.0	0.5 1.0 1.3 1.5	0.10 0.20 0.40 0.60	246 384 346 511	7.0 11.0 14.0 16.0	45 48 50 53	15 18 31 34
12	12	1.0 2.0 2.5 3.0	0.5 1.0 1.3 1.5	0.10 0.20 0.30 0.50	814 333 406 557	7.0 11.0 14.0 16.0	66 68 70 74	18 27 33 38
14	14	2.0 2.5 3.0	1.0 1.3 1.5	0.10 0.25 0.45	724 633 507	11.0 14.0 16.0	85 87 89	22 30 35
16	16	2.0 2.5 3.0	1.0 1.3 1.5	0.10 0.20 0.40	822 720 576	11.0 14.0 16.0	102 104 106	25 34 40
18	18	2.0 2.5 3.0	1.0 1.3 1.5	0.08 0.15 0.35	923 718 646	11.0 14.0 16.0	103 106 108	28 37 42
20	20	2.0 2.5 3.0 3.5	1.0 1.3 1.5 1.8	0.07 0.15 0.20 0.35	1013 788 645 545	11.0 14.0 16.0 17.0	120 124 127 129	32 41 45 48
22	22	2.0 2.5 3.0 3.5	1.0 1.3 1.5 1.8	0.05 0.08 0.15 0.30	1117 869 782 601	11.0 14.0 16.0 17.0	129 134 136 138	35 45 52 53
24	24	2.0 2.5 3.0 3.5	1.0 1.3 1.5 1.8	0.05 0.10 0.15 0.25	1208 940 846 604	11.0 14.0 16.0 17.0	151 155 158 161	38 49 60 65

SERIES 250 SINGLE PLY LOW PRESSURE EXPANSION JOINTS

Nominal Size (ips)	Size Designation	Axial Compression (inches)	Axial Extension (inches)	Lateral Offset from C/L (inches)	Axial Spring Rate (lbs/inch)	Overall Length (inches) (254) (255) (256)	Weight Approx. (lbs) (255) (256)	Weight Approx. (lbs) (254)
26	26	2.0 2.5 3.0 3.5	1.0 1.3 1.5 1.8	0.05 0.10 0.15 0.23	936 702 648 601	11.0 14.0 16.0 17.5	171 177 179 182	51 63 73 83
28	28	2.0 2.5 3.0 3.5	1.0 1.3 1.5 1.8	0.05 0.17 0.10 0.20	1001 751 693 643	11.0 14.0 16.0 17.5	184 190 193 196	60 68 78 89
30	30	2.0 3.0 3.5	1.0 1.5 1.8	0.05 0.08 0.20	1137 910 827	12.0 16.0 18.0	211 218 223	67 92 105
32	32	2.0 3.0 3.5	1.0 1.5 1.8	0.05 0.08 0.20	1218 974 886	12.0 16.0 18.0	252 260 265	70 98 111
34	34	2.0 3.0 3.5	1.0 1.5 1.8	0.05 0.10 0.10	1287 1029 936	12.0 16.0 18.0	256 264 270	76 105 119
36	36	2.0 3.0 3.5	1.0 1.5 1.8	0.05 0.10 0.19	1369 1095 996	12.0 16.0 18.0	279 287 294	81 111 122
38	38	2.0 3.0 3.5	1.0 1.5 1.8	0.05 0.10 0.18	1438 1151 1046	12.0 16.0 18.0	319 327 334	85 116 132
40	40	2.0 3.0 3.5	1.0 1.5 1.8	0.03 0.10 0.16	1508 1206 1096	12.0 16.0 18.0	331 340 348	90 123 140
42	42	2.0 3.0 3.5	1.0 1.5 1.8	0.03 0.09 0.15	1577 1256 1147	12.0 16.0 18.0	356 366 373	94 130 147
44	44	2.0 3.0 3.5	1.0 1.5 1.8	0.02 0.08 0.14	1662 1330 1209	12.0 16.0 18.0	379 388 396	99 136 154
46	46	2.0 3.0 3.5	1.0 1.5 1.8	0.02 0.07 0.14	1732 1386 1255	12.0 16.0 18.0	395 496 414	103 142 161
48	48	2.0 3.0 3.5	1.0 1.5 1.8	0.02 0.06 0.12	1802 1441 1310	12.0 16.0 18.0	419 429 438	108 148 168

Notes:

Bellows and Bellows Extension to Flanges are 321 Stainless Steel.
Flanges are Carbon Steel Plate

Flange Drilling, Sizes 4" through 24", to ANSI B16.5
Flange Drilling, Sizes 26" through 48" to CLASS 125LW.

Weld Ends, Sizes 4" through 24", Standard Wall Carbon Steel Pipe
With 37-1/2 Degree Bevel for Welding

Movements are non-concurrent

Weld Ends. Sizes 26" through 48", 0.375" Thick Wall Carbon Steel with 37-1/2 Degree Bevel for Welding.

Angle Flanges Available for All Sizes. Consult Factory for Angle Size and Drilling

Optional Flow Liner Available.

1-1/2" Through 96" Sizes are Available.

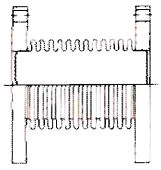
Design Temperature: 800 Degree Fahrenheit.

SERIES 150 SINGLE PLY EXPANSION JOINTS

D.M.E. Series 150 Single Ply Expansion Joints are designed for general purpose applications. Careful consideration in design, manufacturing and quality control insure the Series 150 Expansion Joint will perform in service. The bellows element of the Series 150 Expansion Joint is computer designed using E.J.M.A. standards as guidelines. Modern bellows forming equipment in D.M.E.'s manufacturing facility along with the computer desing produce a quality bellows element for the D.M.E. Series 150 Expansion Joint.

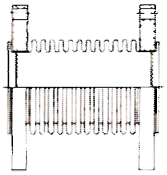
The catalog list the most popular size range, 3" through 24", but D.M.E. is not restricted to these sizes. 1-1/2" through 96" sizes can and are produced at D.M.E.'s facility.
Standard construction is 321 stainless steel bellows, carbon steel plate flanges, and carbon steel weld ends. All flanges on standard products are drilled to match 150# drilling. Optional materials are available for bellows, flanges and weld ends. Optional internal liners, tie rods and shrouds are also available for the Series 150.

Series (151)



Fixed Flange

Series (152)

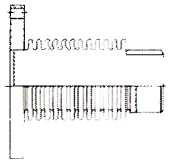


Vanstone Flange

Series (153)

Weld End

Series (154)



Flange x Weld End

150 P.S.I. WORKING PRESSURE 225 P.S.I. TEST PRESSURE

Nominal Size (i.p.s.)	Size Designation	Axial Deflection (inches)	Overall Length Inches (151) (152)	(153))	(154)	Weight Lbs. (151-152)	Weight Lbs. (153)	(Weight Lbs. (154)
3	1.0 1.5	1.0 1.5	6.0 8.0	7.0 9.0	6.75 8.75	15 16	3 4	9 10
3 ½	3.5	1.0 1.5	6.0 8.0	7.0 9.0	6.75 8.75	19 20	4 5	11 12
4	4.0	1.0 1.5	6.0 8.0	7.0 9.0	6.75 8.75	21 22	5 6	12 13
5	5.0	1.25 1.75	7.0 9.0	8.0 10.0	7.5 9.5	23 24	6 7	14 16
6	6.0	1.25 1.75	7.0 9.0	8.0 10.0	7.5 9.5	22 23	7 9	15 16
8	8.0	1.25 1.75 2.50	7.0 9.0 11.0	8.0 10.0 12.0	7.5 9.5 11.5	37 39 40	10 12 14	24 26 27
10	10.0	1.25 1.75 2.50	7.0 9.0 11.0	8.0 10.0 12.0	7.5 9.5 11.5	47 49 51	24 23 23	32 36 40
12	12.0	1.25 1.75 2.50	7.0 9.0 11.0	8.0 10.0 12.0	7.5 9.5 11.5	67 70 72	21 23 28	44 49 54
14	14.0	2.0 2.5 3.0	9.0 11.0 12.0	12.0 13.0 15.0	10.5 11.5 13.0	88 91 92	35 36 42	62 63 67
16	16.0	2.0 2.5 3.0	9.0 11.0 12.0	12.0 13.0 15.0	10.5 12.0 13.0	136 139 140	40 41 48	88 90 94
18	18.0	2.0 2.5 3.0	9.0 11.0 12.0	12.0 13.0 15.0	10.5 12.0 13.0	137 141 142	45 46 54	91 93 98
20	20.0	2.0 2.5 3.0	9.0 11.0 12.0	12.0 13.0 15.0	10.5 12.0 13.0	160 164 166	50 51 60	105 108 113
24	24.0	2.0 2.5 3.0	11.0 13.0 15.0	13.0 16.0 17.0	12.0 14.50 15.75	211 219 225	66 79 80	139 149 152

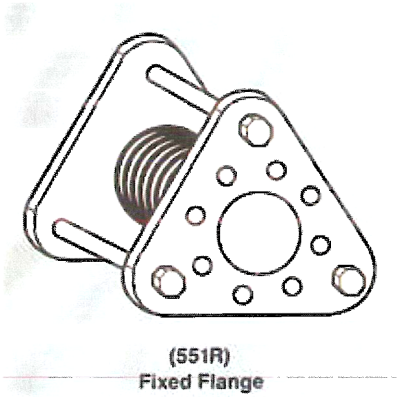
SERIES 550 BELLOWS TYPE PUMP CONNECTORS

D.M.E. Series 550 Multi-Ply Bellows Type Pump Connectors are the solution to vibration and motion isolation when space is at a premium.
Series 550 Bellows Pump Connectors short overall length to motion ratio makes them ideal solutions for pump and machinery isolation in piping systems.
The 550 Series was designed with mechanical equipment protection in mind. Compact and very flexible, the Series 550 Bellows Type Pump Connector reduces noise and vibration transmission while reducing stresses set up between the mechanical equipment and adjacent piping systems.

The convoluted bellows element of the 550 Series is constructed of multiple laminations of type 321 stainless steel, permitting use in high pressure, high temperature application.
Flanges are carbon steel with drilling conforming to ANSI 150#. Tie rods are designed to prevent overtravel and react to full thrust loads resulting from internal pressure.
Type 321 Stainless Steel Flow Liner is available as an option for applications involving severe flow turbulence.
Isolation of the carbon steel flanges from the flow media can be achieved by the use of Vanstone Flanges incorporated in Series 552-R Design.

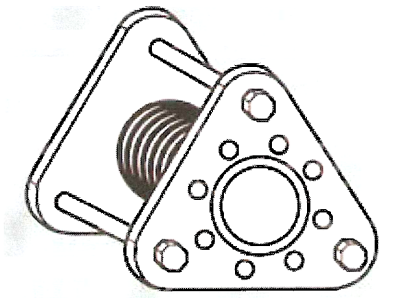
150 P.S.I. WORKING PRESSURE 225 P.S.I. TEST PRESSURE

Nominal Size (i.p.s.)	Size Designation	Overall Length (Inches)		Weight (approx.-Lbs)	
		(551R-552R	(553R)	(551R-552R)	(553R)
3	3	4.0	8.0	28	32
3 ½	3.5	4.0	8.0	33	37
4	4	4.5	8.0	36	42
5	5	4.5	9.0	43	50
6	5	5.0	9.0	48	60
8	8	5.0	9.0	70	85
10	10	6.0	10.0	94	114
12	12	6.0	10.0	123	148



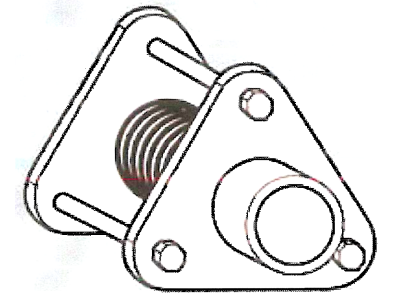
(551R)
Fixed Flange

Allowable Movements (inches)		
Sizes	3" – 8"	10" – 12"
Axial Compression	0.50	0.75
Axial Extension	0.25	0.25
Lateral Offset	0.13	0.13



(552R)
Vanstone Flange

Pressure Thrust						
Pipe Size (i.p.s.)	Effective Area (sq. inches)	50 P.S.I.	75 P.S.I.	100 P.S.I.	125 P.S.I.	150 P.S.I.
3	12.06	603	905	1206	1508	1809
3 ½	15.34	767	1151	1534	1918	2301
4	19.71	986	1478	1971	2464	2957
5	29.78	1498	2978	3723	4467	
6	40.94	2047	3071	4094	5118	6141
8	66.76	3338	5007	6676	8345	10014
10	106.04	5302	7953	10604	13255	15906
12	145.69	7285	14569	18211	21845	



(553R)
Weld End

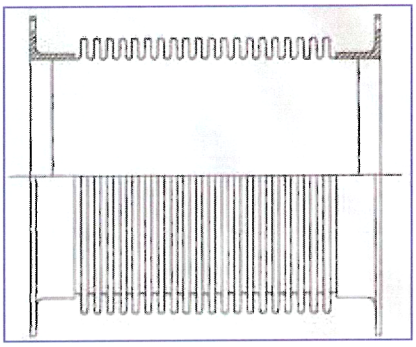
Notes:
Flanges are Carbon Steel Plate with Drilling Conforming to ANSI B16.5 Class 150.
Weld Ends are Standard Wall Carbon Steel Pipe 37 ½Degree Bevel.
Bellows are 321 Stainless Steel Multi-Ply Construction.
Working Pressure of 150 P.S.I. is at 800 Degree Fahrenheit.
Optional Flow Liner is available.

SERIES 400 DUCT EXPANSION JOINTS

5 P.S.I. WORKING PRESSURE 950 DEGREE F.

NOMINAL SIZE	AXIAL MOVEMENT	ANGLE FLANGE SIZE	TUBE END LENGTH AND THICKNESS	OVERALL LENGTH (IN) SERIES 451 & 453
16" 18" 20" 22" 24"	1.75 3.50 5.25	1-3/4" X 1-3/4" X 3/16"	1-3/4" X 3/16"	8.75 14.00 19.25
26" 28" 30" 32" 34"	1.75 3.63 5.50	2" X 2" 3/16"	2" X 3/16"	9.00 14.00 19.00
36" 38" 40" 42" 44" 46" 48"	2.50 3.75 5.00	2" X 2" X 3/16"	2" X 3/16"	11.50 15.25 19.00
50" 52" 54" 60" 66"	2.50 3.75 5.00	3" X 3" X 1/4"	3" X 1/4"	13.50 17.25 21.00
72" 78" 84" 90" 90" 96"	2.50 3.75 5.00	3" X 3" X 3/8"	3" X 3/8"	13.50 17.25 21.00

MODEL 451 ANGLE FLANGES ***

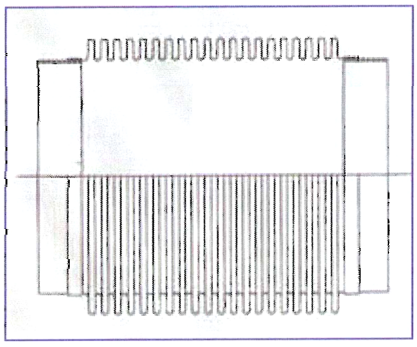


- Bellows material is A 240 type 321 stainless steel
- Flanges and weld ends are A 36 carbon steel.

*** Bolt patterns per customer's requirements.

- Bellows and end fittings can be manufactured from all available materials.

MODEL 453 TUBE ENDS



- Bellows with heavy wall thickness also available.
- Options include flow liners, external shrouds, and plate flanges.
- Tube ends can be ordered to fit over customer's tube.
- Most in-between sizes and metric sizes available.

SERIES T050 & T150 TIED UNIVERSAL EXPANSION JOINTS

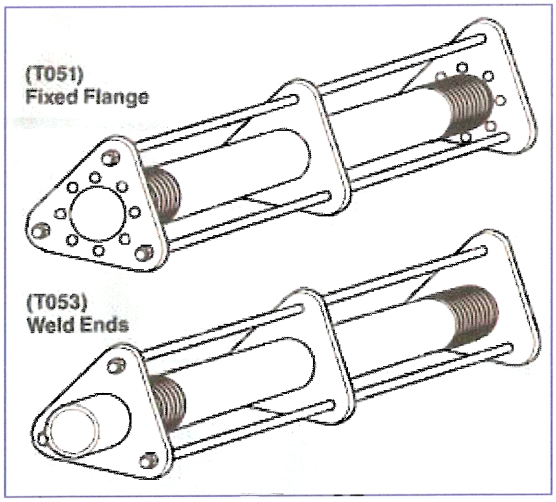
D.M.E. Tied Universal Bellows Expansion Joints are designed to absorb large amounts of lateral deflection along with a small amout of axial motion in the standard catalog configurations. (increased lateral deflection and axial motion can be achieved by adding to overall length.)

The ability of Tied Universal Expansion Joints to absorb motion in multiple planes makes it the ideal expansion joint for floating systems where main anchors are not practical.

SERIES T050 SINGLE PLY BELLOWS

50 P.S.I. WORKING PRESSURE
75 P.S.I. TEST PRESSURE

Nominal Size (i.p.s.)	Size Designation	Overall Length (Inches)		Weight (approx.-Lbs)	
		(T051)	(T053)	(T051)	(T053)
3	3.0	26	32	56	62
3 ½	3.5	26	32	64	71
4	4.0	26	32	72	80
5	5.0	26	32	95	105
6	6.0	26	32	99	112
8	8.0	30	36	153	173
10	10.0	30	36	198	225
12	12.0	30	36	251	285
14	14.0	30	36	270	301
16	16.0	30	36	310	346
18	18.0	32	38	340	380
20	20.0	32	38	389	431
22	22.0	32	38	425	470
24	24.0	32	38	495	547



Series T050 Universal Tied Expansion Joints are Rated for 2.0" Lateral Offset from Center Line and 0.5" Axial Compression, Concurrent Motions.

Additional Lateral: For Each Additional 1.0" of lateral Offset Required Add 11.5" to Overall Length.

Bellows Material is 321 Stainless Steel.

Flange Material is Carbon Steel with Drilling Conforming to ANSI B16.5 Class 150 Drilling.

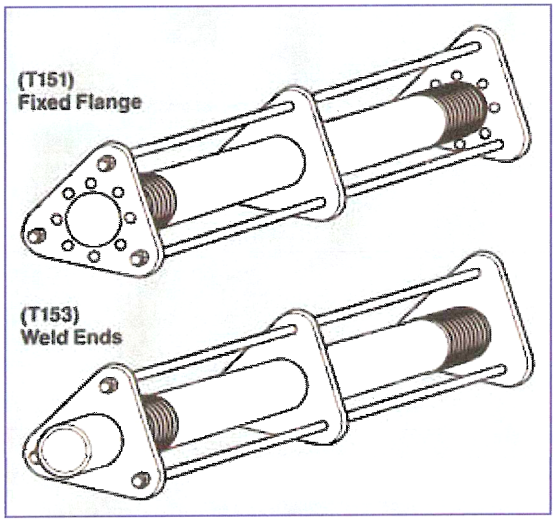
Weld End Material is Standard Wall Thickness Carbon Steel Pipe. 37 ½ Degree Bevel for Welding

Design Temperature: 800 Deg. F.

SERIES T150 SINGLE PLY BELLOWS

150 P.S.I. WORKING PRESSURE
225 P.S.I. TEST PRESSURE

Nominal Size (i.p.s.)	Size Designation	Overall Length (Inches)		Weight (approx.-Lbs)	
		(T051)	(T053)	(T051)	(T053)
3	3.0	26	32	57	63
3 ½	3.5	26	32	65	72
4	4.0	26	32	73	81
5	5.0	26	32	96	106
6	6.0	26	32	100	113
8	8.0	30	36	155	175
10	10.0	30	36	200	227
12	12.0	30	36	253	287



Series T150 Universal Tied Expansion Joints are Rated for 2.0" Lateral Offset from Center Line and 0.5" Axial Compression, Concurrent Motions.

Additions Lateral: For Each Additional 1.0" of Lateral Offset Required Add 11.5" to Overall Length.

Bellows Material is 321 Stainless Steel.

Flange Material is Carbon Steel with Drilling Conforming to ANSI B16.5 Class 150 Drilling.

Weld End material is Standard Wall Thickness Carbon Steel Pipe. 37 ½ Degree Bevel for Welding.

Design Temperature: 800 Deg. F.

SERIES 650 MULTI-PLY EXHAUST EXPANSION JOINTS

D.M.E. series 650 Multi-Ply Exhaust Expansion Joints, the answer to those demanding exhaust expansion joint application. Engineered to overcome exhaust system piping motion and vibration.

Designed with prime power and marine systems in mind, the Series 650 has proven itself in the field.

The multi-ply bellows is capable of absorbing vibration as well as the listed motions. This capability along with low spring rates reduces the loads on the system imposed by the Series 650 Expansion Joint.

Today's modern engine package systems require the sophistication designed into the Series 650 Expansion Joint. Its ability to operate at a higher temperature over long periods of time insures minimum downtime and greater system reliability.

The marine industry recognized the importance of reliable exhaust expansion joints and has come to D.M.E. for the Series 650 Exhaust Expansion Joints.

The Series 650 bellows element (unlike flexible metal hose) is specifically engineered to exhaust applications. The bellows attachment welds are made at the bellows neck which is a low stress point, not at the I.D. or O.D. of a corrugation as on flex hose. The corrugation height is greater, improving flexibility and reducing the spring rates. Multi-Ply construction provides a dampening effect on vibration instead of transmitting it to the system. Non-standard overall expansion joint lengths can be provided because of the flexibility of D.M.E.'s manufacturing processes.

When it comes to exhaust expansion joint installations and exhaust expansion joint problems. D.M.E. and the Series 650 are ready to serve you. Series 650 bellows element is constructed of multi-plys of 321 stainless steel. Flanges are carbon steel with drilling conforming to A.N.S.I. 150#. Special flange drilling is available to match specific applications. Weld ends are standard wall carbon steel pipe. Flow liners can be provided as an option.

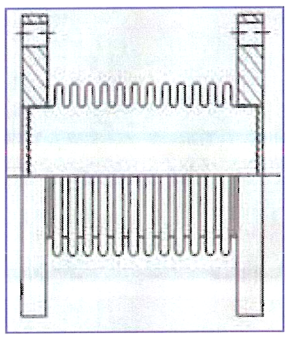
The Series 650 with vanstone flanges is available when flange hole alignment may be a problem.

SERIES 650 MULTI-PLY EXHAUST EXPANSION JOINTS

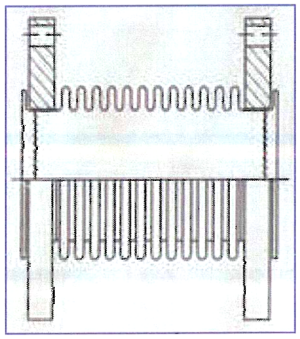
Nominal Size (i.p.s.)	Size Designation	Axial Compression (inches)	Lateral Offset from C/L (inches)	Axial Spring Rate (lbs/inch)	Lateral Spring Rate (lbs/inch)	Overall Length (inches) (655) (656)	(653)	Weight Approx. (lbs) (656)	(653)
3	3.0-7 3.0-12	3.5 3.5	.63 1.0	183 107	87 17	8.0 13.0	11.0 16.0	9 10	5 6
4	4.0-7 4.0-12	2.0 3.5	.63 1.0	136 79	106 21	8.0 13.0	11.0 16.0	12 14	7 9
5	5.0-7 5.0-12	2.0 3.5	.63 1.0	144 86	159 34	8.0 13.0	11.0 16.0	14 16	8 10
6	6.0-7 6.0-12	2.5 4.0	.63 1.0	165 99	249 53	8.0 13.0	11.0 16.0	16 19	11 13
8	8.0-7 8.0-12	2.5 4.0	.63 1.0	206 123	505 109	8.0 13.0	11.0 16.0	28 31	15 19
10	10.0-7 10.0-12	3.0 4.5	.50 .88	115 70	454 103	8.0 13.0	11.0 16.0	35 40	21 25
12	12.0-7 12.0-12	3.0 4.5	.50 .88	132 80	717 163	8.0 13.0	12.0 17.0	50 55	25 31
14	14.0-7 14.0-12	3.0 4.5	.50 .88	108 64	751 162	8.0 13.0	12.0 17.0	59 66	25 33
16	16.0-7 16.0-12	3.0 4.5	.50 .88	121 72	1078 232	9.0 14.0	12.0 17.0	101 108	28 35
18	18.0-7 18.0-12	3.0 4.5	.50 .88	131 78	1355 314	9.0 14.0	12.0 17.0	102 110	32 40
20	20.0-7 20.0-12	3.0 4.5	.38 .50	141 84	1916 414	9.0 14.0	12.0 17.0	114 122	35 44
22	22.0-7 22.0-12	3.0 4.5	.38 .50	157 94	2548 550	9.0 14.0	12.0 17.0	129 138	39 48
24	24.0-7 24.0-12	3.0 4.5	.38 .50	168 101	3225 696	9.0 14.0	12.0 17.0	150 161	42 53

Notes:
Series (655, 656) have D.M.E. standard Plate Flanges. ½Thick A -36 Carbon Steel
Series (653) Sizes 3" through 12" have standard Waii Thick Weld Ends.
Series (653) Sizes 14" through 24" have .375 Thick Weld Ends.

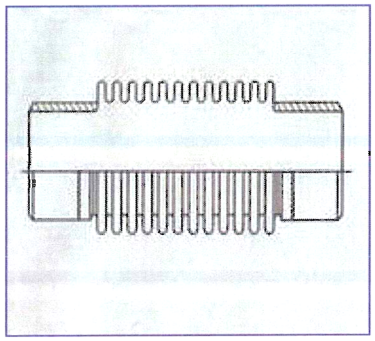
1 ½Through 96" Diameter Sizes are Available.
Design Temperature 950 Deg. F. Higher Temperature Ratings Available.



(655)
Fixed Flange



(656)
Vanstone Flange

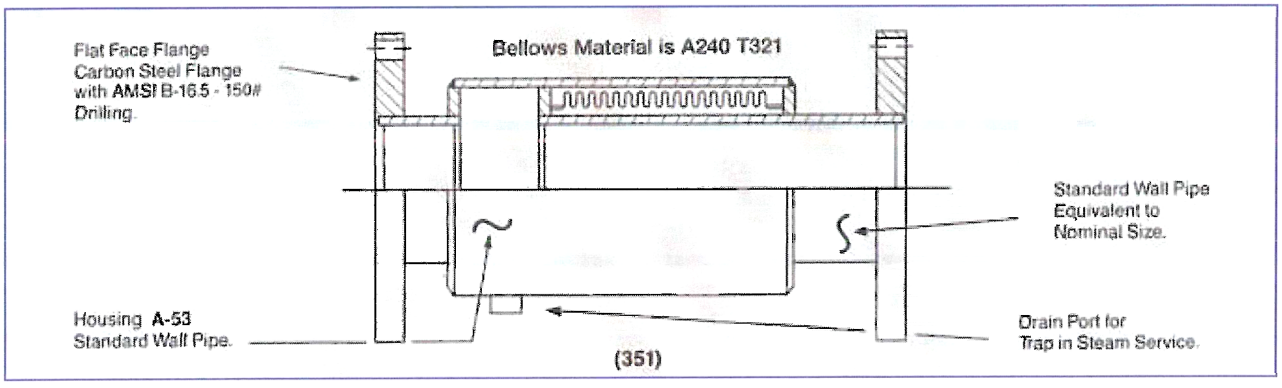


(653)
Weld End

SERIES 350 EXTERNALLY PRESSURIZED EXPANSION JOINTS

150 P.S.I. WORKING PRESSURE 225 P.S.I. TEST PRESSURE 750 DEG. F.

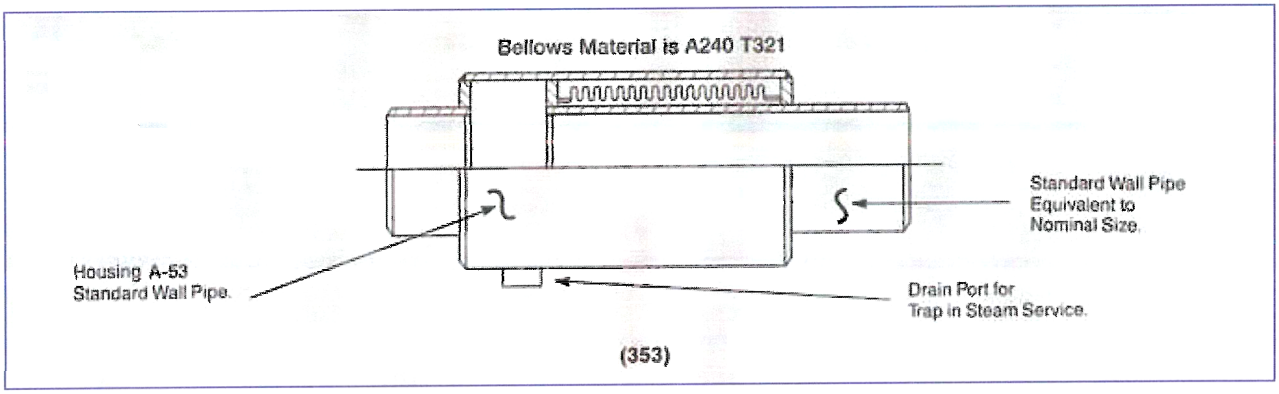
Nominal Size (inches)	Part Number	Axial Compression (inches)	Axial Extension (inches)	Housing Outside Diameter	Axial Spring Rate (lbs/inch)	Overall Length (inches)	Weight Approx. (lbs)
2	351-2-4.0 351-2-6.0 351-2-8.0	4.0 6.0 8.0	1.0 2.0 2.0	4.5	219 146 121	24.75 33.75 40.25	35 44 50
2 ½	351-2.5-4.0 351-2.5-6.0 351-2.5-8.0	4.0 6.0 8.0	1.0 2.0 2.0	5.56	233 153 116	24.75 33.75 40.25	49 63 71
3	351-3-4.0 351-3-6.0 351-3-8.0	4.0 6.0 8.0	1.0 2.0 2.0	6.63	264 174 132	24.75 33.75 40.25	62 79 90
3 ½	351-3.5-4.0 351-3.5-6.0 351-3.5-8.0	4.0 6.0 8.0	1.0 2.0 2.0	6.63	362 241 197	24.75 33.75 40.25	67 85 97
4	351-4-4.0 351-4-6.0 351-4-8.0	4.0 6.0 8.0	1.0 2.0 2.0	8.63	397 235 198	24.75 33.75 40.25	92 117 133
5	351-5-4.0 351-5-6.0 351-5-8.0	4.0 6.0 8.0	1.0 2.0 2.0	10.75	424 265 223	24.75 33.75 40.25	97 125 143
6	351-6-4.0 351-6-6.0 351-6-8.0	4.0 6.0 8.0	1.0 2.0 2.0	10.75	536 371 268	26.50 35.25 41.25	139 177 202
8	351-8-4.0 351-8-6.0 351-8-8.0	4.0 6.0 8.0	1.0 2.0 2.0	12.75	812 575 460	26.50 35.25 41.25	187 250 274
10	351-10-4.0 351-10-6.0 351-10-8.0	4.0 6.0 8.0	1.0 2.0 2.0	16	1524 996 864	26.50 35.25 41.25	259 327 370
12	351-12-4.0 351-12-6.0 351-12-8.0	4.0 6.0 8.0	1.0 2.0 2.0	18	1152 768 658	28.75 37.25 44.50	340 417 475
14	351-14-4.0 351-14-6.0 351-14-8.0	4.0 6.0 8.0	1.0 2.0 2.0	20	1314 876 750	28.75 37.25 44.50	392 480 545



SERIES 350 EXTERNALLY PRESSURIZED EXPANSION JOINTS

150 P.S.I. WORKING PRESSURE 225 P.S.I. TEST PRESSURE 750 DEG. F.

Nominal Size (inches)	Part Number	Axial Compression (inches)	Axial Extension (inches)	Housing Outside Diameter	Axial Spring Rate (lbs/inch)	Overall Length (inches)	Weight Approx. (lbs)
2	353-2-4.0 353-2-6.0 353-2-8.0	4.0 6.0 8.0	1.0 2.0 2.0	4.5	219 146 121	24.25 33.25 39.75	26 35 41
2 ½	353-2.5-4.0 353-2.5-6.0 353-2.5-8.0	4.0 6.0 8.0	1.0 2.0 2.0	5.56	233 153 116	24.25 33.25 39.75	37 50 59
3	353-3-4.0 353-3-6.0 353-3-8.0	4.0 6.0 8.0	1.0 2.0 2.0	6.63	264 174 132	24.25 33.25 39.75	48 65 76
3 ½	353-3.5-4.0 353-3.5-6.0 353-3.5-8.0	4.0 6.0 8.0	1.0 2.0 2.0	6.63	362 241 197	24.25 33.25 39.75	50 68 80
4	353-4-4.0 353-4-6.0 353-4-8.0	4.0 6.0 8.0	1.0 2.0 2.0	8.63	397 235 198	24.25 33.25 39.75	74 98 114
5	353-5-4.0 353-5-6.0 353-5-8.0	4.0 6.0 8.0	1.0 2.0 2.0	10.75	424 265 223	24.25 33.25 39.75	77 105 123
6	353-6-4.0 353-6-6.0 353-6-8.0	4.0 6.0 8.0	1.0 2.0 2.0	10.75	536 371 268	26.00 34.75 40.75	116 154 178
8	353-8-4.0 353-8-6.0 353-8-8.0	4.0 6.0 8.0	1.0 2.0 2.0	12.75	812 575 460	26.00 34.75 40.75	153 206 240
10	353-10-4.0 353-10-6.0 353-10-8.0	4.0 6.0 8.0	1.0 2.0 2.0	16	1524 996 864	26.00 34.75 40.75	216 285 328
12	353-12-4.0 353-12-6.0 353-12-8.0	4.0 6.0 8.0	1.0 2.0 2.0	18	1152 768 658	28.25 36.75 44.00	279 355 413
14	353-14-4.0 353-14-6.0 353-14-8.0	4.0 6.0 8.0	1.0 2.0 2.0	20	1314 876 750	28.25 36.75 44.00	314 403 468

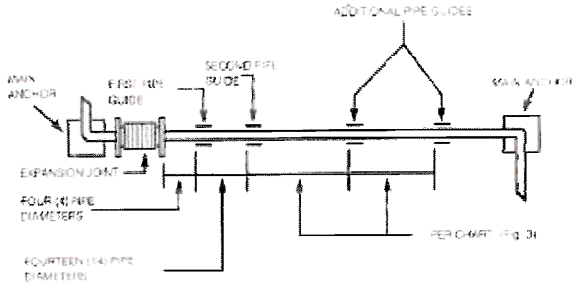


(353)

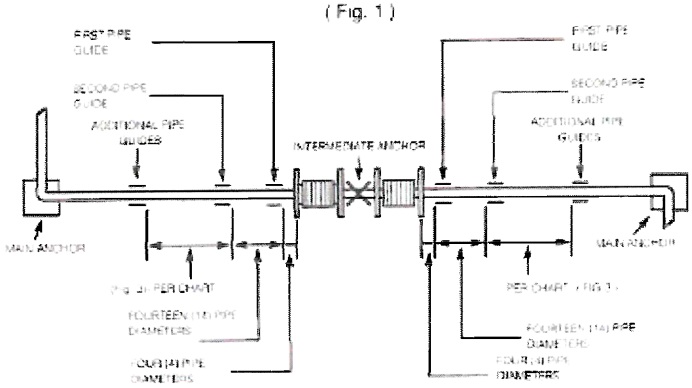
ANCHORING AND GUIDING

In a piping system containing expansion joints that absorb axial motion, it is important to properly anchor and guide the pipes to insure the expansion joint absorbs the motion for which it was designed. Inadequate anchoring and improper guiding can cause stresses that reduce the expansion joint's life, cause pipe buckling and system failure. When an expansion joint is pressurized, internal thrust forces are created which react on the system and anchors. This force is due to internal pressure acting on the effective area of the bellows element in the expansion joint.

This force created by pressure must be absorbed in the piping system by anchors to prevent the bellows element from extending. Anchors in a piping system are generally of two kinds, main anchors to absorb full pressure thrust forces generated by the expansion joint, and intermediate anchors to absorb forces generated by the expansion joint bellows spring forces.



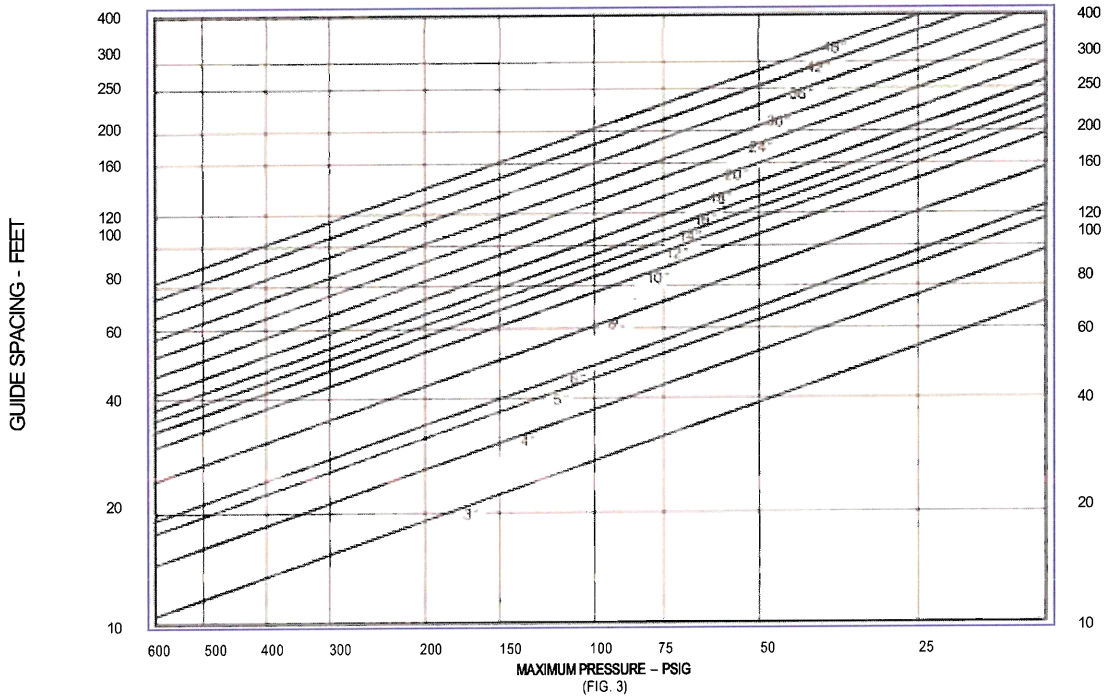
(Fig. 1)



(Fig. 2)

Spacing for Pipe Guides in Expansion Joint Applications.
These recommendations are shown in the diagram (fig. 1 – fig. 2) and the accompanying guide spacing chart (fig. 3). Examples of main anchors and intermediate anchors are also shown in the diagram. It should be noted that pipe guides are intended to guide the pipes in a system and not support the weight of pipes and media conveyed through them.

MAXIMUM RECOMMENDED SPACING FOR PIPE GUIDES
(AXIAL DEFLECTION ONLY – STANDARD WEIGHT CARBON STEEL PIPE)



(FIG. 3)

THERMAL EXPANSION OF PIPE TABLE

Thermal Expansion of Pipe in Inches Per 100 Feet

Saturated Steam Vacuum in HG below 212°F. Pressure, PSIG Above 212°F	Temp Deg Fahr	Cast Iron	Carbon and Carbon Molybdenum	Wrought Iron	4-6% Cr Alloy Steel	18 Cr. 8 Ni Stainless Steel	Copper
	-200	-1.058	-1.282	-1.289	-1.250	-2.030	-1.955
	-180	-0.982	-1.176	-1.183	-1.150	-1.850	-1.782
	-160	-0.891	-1.066	-1.073	-1.030	-1.670	-1.612
	-140	-0.797	-0.948	-0.955	-0.970	-1.480	-1.428
	-120	-0.697	-0.826	-0.833	-0.800	-1.300	-1.235
	-100	-0.593	-0.698	-0.705	-0.700	-0.900	-1.040
	-80	-0.481	-0.563	-0.570	-0.550	-0.880	-0.835
	-60	-0.368	-0.428	-0.435	-0.430	-0.670	-0.630
	-40	-0.248	-0.288	-0.295	-0.290	-0.450	-0.421
	-20	-0.127	-0.145	-0.152	-0.145	-0.225	-0.210
	0	0	0	0	0	0	0
	20	0.12	0.148	0.180	0.140	0.223	0.238
	32	0.209	0.230	0.280	0.234	0.356	0.366
	40	0.270	0.300	0.350	0.280	0.446	0.451
29.39	60	0.410	0.448	0.540	0.430	0.669	0.684
28.89	80	0.550	0.580	0.710	0.500	0.892	0.896
27.99	100	0.680	0.753	0.887	0.650	1.115	1.134
26.48	120	0.830	0.910	1.058	0.800	1.338	1.366
24.04	140	0.970	1.064	1.240	0.950	1.545	1.590
20.27	160	1.110	1.200	1.420	1.100	1.784	1.804
14.63	180	1.240	1.360	1.580	1.250	2.000	2.051
6.45	200	1.390	1.520	1.750	1.400	2.230	2.296
0	212	1.480	1.610	1.870	1.500	2.361	2.428
2.5	220	1.530	1.680	1.940	1.550	2.460	2.516
10.3	240	1.670	1.840	2.120	1.720	2.680	2.756
20.7	260	1.820	2.020	2.300	1.880	2.920	2.985
34.5	280	1.970	2.180	2.470	2.050	3.150	3.218
52.3	300	2.130	2.350	2.670	2.200	3.390	3.461
74.9	320	2.268	2.530	2.850	2.370	3.615	3.696
103.3	340	2.430	2.700	3.040	2.530	3.840	3.941
138.3	360	2.590	2.880	3.230	2.700	4.100	4.176
180.9	380	2.750	3.060	3.425	2.860	4.346	4.424
232.4	400	2.910	3.230	3.620	3.010	4.580	4.666
293.7	420	3.090	3.421	3.820	3.180	4.800	4.914
366.1	440	3.250	3.595	4.020	3.350	5.050	5.154
451.3	460	3.410	3.784	4.200	3.530	5.300	5.408
550.3	480	3.570	3.955	4.400	3.700	5.540	5.651
664.3	500	3.730	4.151	4.600	3.860	5.800	5.906
795.3	520	3.900	4.342	4.810	4.040	6.050	6.148
945.3	540	4.080	4.525	5.020	4.200	6.280	6.410
1115	560	4.250	4.730	5.220	4.400	6.520	6.646
1308	580	4.430	4.930	5.430	4.560	6.780	6.919
1525	600	4.600	5.130	5.620	4.750	7.020	7.184
1768	620	4.790	5.330	5.840	4.920	7.270	7.432
2041	640	7.970	5.530	6.050	5.100	7.520	7.689
2346	660	5.150	5.750	6.250	5.300	7.770	7.949
2705	680	5.330	5.950	6.470	5.480	8.020	8.196
3080	700	5.520	6.160	6.670	5.650	8.280	8.472
	720	5.710	6.360	6.880	5.850	8.520	8.708
	740	5.900	6.570	7.100	6.030	8.780	8.999
	760	6.090	6.790	7.320	6.220	9.050	9.256
	780	6.280	7.000	7.530	6.410	9.300	9.532
	800	6.470	7.230	7.730	6.610	9.580	9.788
	820	6.660	7.450	7.960	6.800	9.820	10.068
	840	6.850	7.660	8.180	7.000	10.100	10.308
	860	7.049	7.970	8.400	7.190	10.370	10.610
	880	7.248	8.100	8.630	7.380	10.630	10.971
	900	7.460	8.340	8.870	7.580	10.900	11.156
	920	7.668	8.540	9.070	7.770	11.180	11.421
	940	7.862	8.770	9.300	7.970	11.460	11.707
	960	8.073	8.990	9.520	8.170	11.730	11.976
	980	8.300	9.220	9.740	8.360	12.000	12.269
	1000	8.510	9.420	9.970	8.550	12.260	12.543
	1020		9.65		8.75	12.55	
	1040		9.87		8.95	12.82	
	1060		10.08		9.15	13.10	
	1080		10.32		9.35	13.37	
	1100		10.57		9.54	13.62	
	1120		10.75		9.75	13.91	
	1140		10.98		9.95	14.17	
	1160		11.21		10.15	14.45	
	1180		11.43		10.36	14.72	
	1200		11.63		10.49	14.98	
	1220		11.87		10.75	15.26	
	1240		12.10		10.95	15.53	
	1260		12.33		11.15	15.81	
	1280		12.55		11.35	16.08	
	1300		12.75		11.55	16.34	
	1320		12.98		11.75	16.62	
	1340		13.21		11.95	16.90	
	1360		13.42		12.15	17.17	
	1380		13.65		12.35	17.43	
	1400		13.87		12.54	17.70	
	1420					17.98	
	1440					18.25	
	1460					18.52	
	1480					18.80	
	1500					19.07	

From the Piping Handbook
By Sabin Crocker,
Mcgraw-Hill Publishing Co.
& Acme Paper No. 53-A-52, 1954.

The first step in the selection of an expansion joint is to compute the exact change in the linear dimensions of the piping system; the next is to consider a safety factor. The actual expansion of a 100-foot length of pipe has been computed at different temperatures for various materials commonly used in piping.

Given:

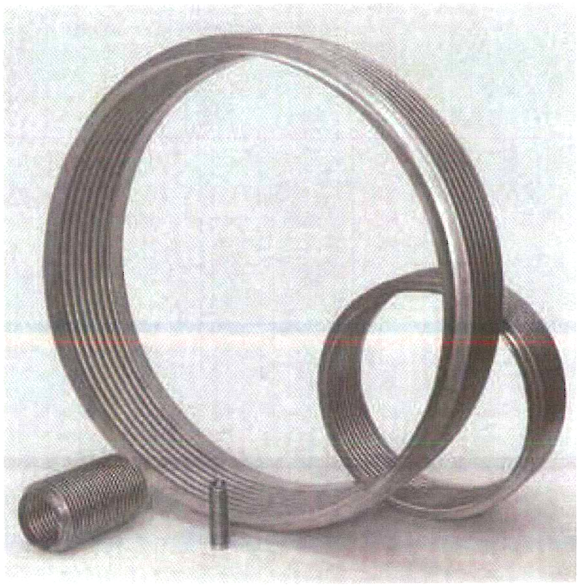
150-foot-long, 6" diameter steel steam line
Maximum steam temperature in service.....380°F.
Minimum winter temperature to be encountered.....15°F.

Calculated Traverse:

From Table 10, the expansion of carbon steel pipe at:
380°F.....3.060 in. per 100 ft. of pipe
15°F.....,111 in. per 100 ft. of pipe
Difference.....2.949 in. per 100 ft. of pipe

For 150 feet of pipe the expansion is proportionately larger.

Thus, Calculated Traverse = 150/100 x 2.949" = 4.42"



STAINLESS STEEL FLEXIBLE CONNECTORS

DME stainless steel braided flexible connectors are designed for use in gas and oil connections to absorb engine vibration, to correct minor piping misalignment, compensate for thermal growth and reduce piping stress. All DME flexible connectors are 100% pressure tested before shipment to insure a leak-proof system.

DME also manufactures braided flexible connectors to any length dimension, with any type of end fitting combination, in various metals to suit your special applications.

TYPE MM
¼ – 4" Size
Male Pipe
Thread Ends

TYPE MUF
¼ – 4" Size
Male Pipe x
Female Pipe Union

TYPE FF
½ – 12" Size
150# ASA Fixed
Flange Ends

TYPE F/FL
2" – 12" Size
150# ASA Fixed x
Floating Flanges

Fuel, Oil, Water, and Gas Connectors

	LENGTH/TYPE (INCHES)				Working Pressure @70° F	Maximum Temperature	Bend Radius Inches	Maximum Offset ± Centerline Inches
Size Inches	MM	MUF	FF	F/FL				
1/4	10	10	--	--	2375	850° F	6	3/4
3/8	10	10	--	--	1650	850° F	7	3/4
1/2	10	10	10	--	1100	850° F	8	3/4
3/4	11	11	10	--	800	850° F	10	3/4
1	12	12	10	--	750	850° F	11	3/4
1-1/4	13	13	10	--	725	850° F	12-1/2	3/4
1-1/2	14	14	10	--	565	850° F	14	3/4
2	15	15	10	10	500	850° F	17	3/4
2-1/2	18	18	12	12	400	850° F	20	3/4
3	18	18	12	12	288	850° F	22	3/4
3-1/2	20	20	12	12	250	850° F	25	3/4
4	20	20	16	16	250	850° F	27	3/4
5	--	--	16	16	200	850° F	31	3/4
6	--	--	18	18	175	850° F	36	3/4
8	--	--	18	18	212	850° F	62	3/4
10	--	--	20	20	175	850° F	65	3/4
12	--	--	20	20	160	850° F	66	3/4

GRAINGER
FOR THE ONES WHO GET IT DONE

printed February 11, 2010

Flexible Metal Hose, 4 In, 18 Length

Flexible Metal Hose, Dia 4 In, Length 18 In, Max Working Pressure @ 70 F 299, Static Min Bend Radius 9.8 In, Dynamic Min Bend Radius 22 In, Max Temp 1200 F, Fitting Type 304 Stainless steel male NPT x 304 Stainless Steel Male NPT, 304 Stainless Steel Braid Material, 321 Stainless Steel Hose Material

Grainger Item #	4FJN4
Price (ea.)	**$251.25**
Brand	HOSE MASTER
Mfr. Model #	G400SM180
Ship Qty.	1
Sell Qty. (Will-Call)	1
Ship Weight (lbs.)	7.71
Usually Ships	1-3 Days
Catalog Page No.	3772

Price shown may not reflect your price. Log in or register.

Additional Info

Flexible Metal Hose Assemblies

Highly flexible hoses absorb vibration and compensate for misalignment, for easier hookup.

316 stainless steel hoses offer better corrosion and pitting resistance than 321 stainless steel.

Hose assemblies have a 304 stainless steel braid.

Uses: Ideal for air compressors, liquid and vacuum pumps, and pump suction discharge lines.

304 Stainless Steel, MNPT x MNPT

- Max. temp.: 1200 DegreeF

Tech Specs

Item: Flexible Metal Hose
Dia. (In.): 4
Length (In.): 18
Max. Working Pressure @ 70 F: 299
Static Min. Bend Radius (In.): 9.8
Dynamic Min. Bend Radius (In.): 22
Max. Temp. (F): 1200
Fitting Type: 304 Stainless steel male NPT x 304 Stainless Steel Male NPT
Braid Material: 304 Stainless Steel
Hose Material: 321 Stainless Steel

Notes & Restrictions

There are currently no notes or restrictions for this item.

MSDS

This item does not require a **Material Safety Data Sheet (MSDS).**

Required Accessories

There are currently no required accessories for this item.

Optional Accessories

There are currently no optional accessories for this item.

Alternate Products

There are currently no alternate products for this item.

Repair Parts

A Repair Part may be available for this item. Visit our Repair Parts Center or contact your local branch for more information.

Series 8500 Expansion Compensators

Type 8503 Cut-a-way

- Sizes 3/4" through 4"
- Threaded, welded, flanged and grooved steel pipe joints
- Male and female copper sweat ends
- Design pressure: 200 psig
- Axial travel: 2" and 3"
- Fully enclosed externally pressurized multiply stainless steel bellows
- Internal guides maintain alignment
- Compact space saving design

Temperature changes in heat transfer system piping, tubing, heaters, radiators, solar panels, and other equipment create expansion and contraction that must be absorbed.

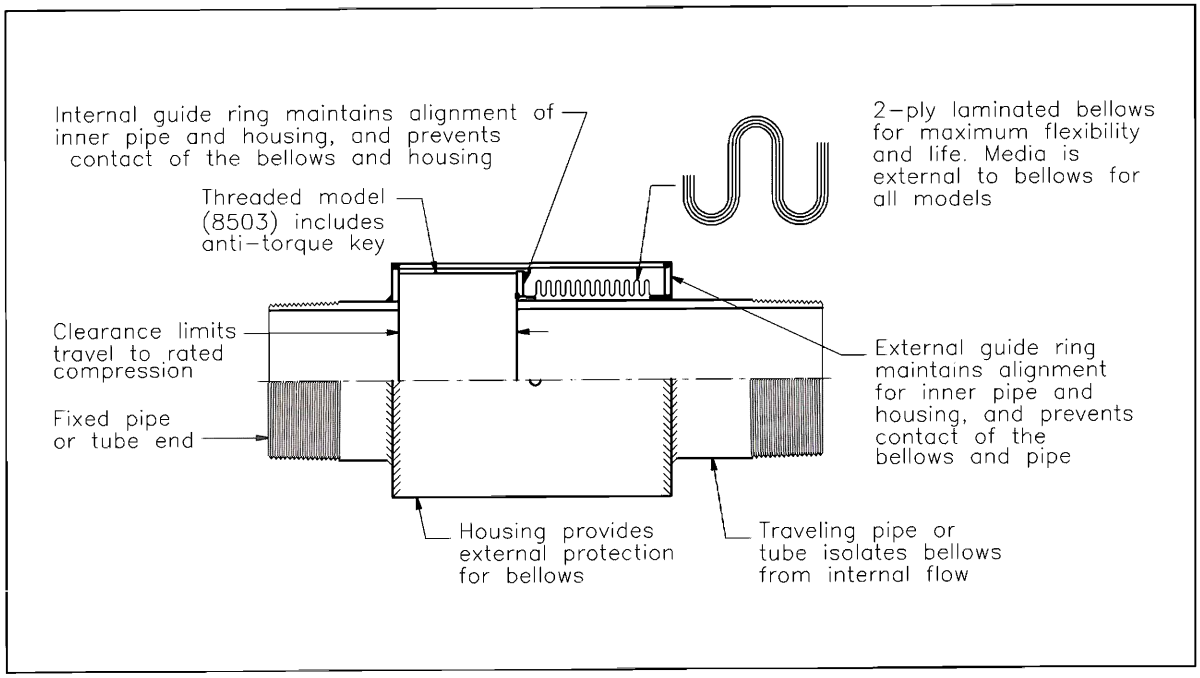
Expansion Compensators provide a maintenance free, compact, economical and reliable method of eliminating this problem.

The compact design of Expansion Compensators permits installation within tight spaces, and the inline construction minimizes pressure drop and heat loss. The metal bellows is fully enclosed, and internal and external guides maintain alignment.

All welded or high-temperature brazed construction eliminates the need for maintenance. They are assembly line produced for economy, and they are available from stock.

Warranty
Full three year replacement warranty
— see page 7 for details.

Design Features

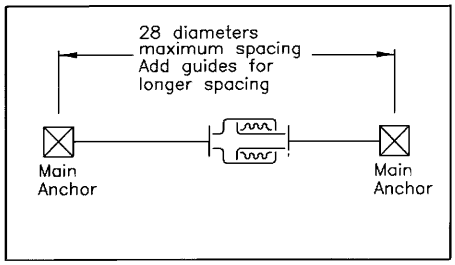


Applications

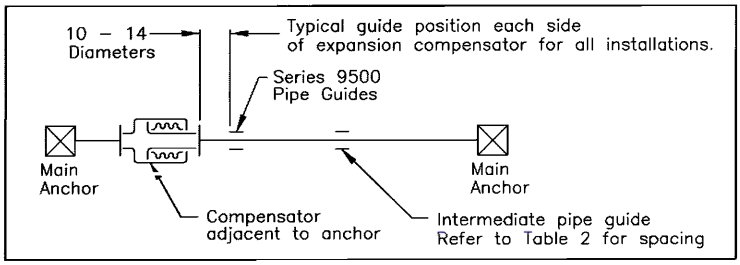
Series 8500 Expansion Compensators are designed for installations where the principal movement is axial. Standard joints are designed for 2" or 3" axial compression (pipe expansion) and 0.5" extension. If the primary movement is extension (pipe contraction) the compensator can be preset at the factory. The piping system must include anchors to react the force produced by pressure thrust and the bellows spring constant, supports to react the weight of the pipe and media, and guides to ensure that the pipe alignment is maintained.

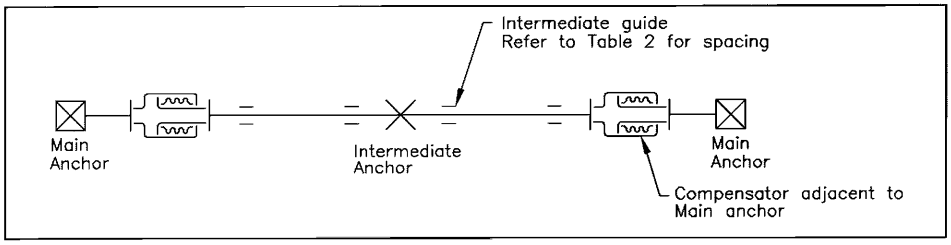
Refer to Table 2 for the intermediate guide spacing in the center of runs.

Short run between heaters or solar panels



Run requiring only one compensator





Run requiring more than one compensator

See page 6 for calculation methods for travel required and anchor forces.

Table 1 Thermal Expansion

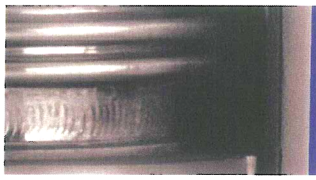
Saturated Steam Pressure		Temperature Deg F	Temperature Deg C	Copper Tube	Carbon Steel Pipe
		–325	–198		
		–300	–185		
		–250	–157		
		–200	–129	–2.85	
		–150	–101	–1.81	
		–100	–73	–1.81	
		–50	–46	–1.32	–0.84
		0	–18	–0.75	–0.49
		25	–4	–0.47	–0.32
Vacuum (inches of mercury)	29.7	32	0	–0.39	–0.27
	29.6	50	10	–0.19	–0.14
	29.2	70	21	–0	0
	28.0	100	38	0.38	0.23
	26.0	125	52	0.66	0.42
	22.4	150	66	0.94	0.61
	16.3	175	80	1.23	0.80
	6.0	200	93	1.51	0.99
	0	212	100	1.65	1.10
Pressure (psig)	4	225	107	1.80	1.21
	5	250	121	2.09	1.40
	31	275	135	2.38	1.61
	52	300	149	2.67	1.82
	120	350	177	3.27	2.26
	150	358	181	3.37	2.33
	300	417	214	4.09	2.86
	666	500	260	5.09	3.62

Linear thermal expansion of pipe or tube per 100 feet between 70°F & tabulated temperature

Table 2 Intermediate Guide spacing

	Nominal Size	Pressure (psig) 50	75	100	150	200
Models 8503 – 8506 Schedule 40 Carbon Steel Pipe	3/4	7.7	7.3	6.9	6.3	5.8
	1	11.9	11.0	10.3	9.2	8.4
	1-1/4	16.3	14.7	13.5	11.7	10.5
	1-1/2	19.4	17.2	15.6	13.4	11.9
	2	26.8	23.2	20.7	17.5	15.4
	2-1/2	31.3	27.5	24.8	21.2	18.8
	3	38.8	33.5	29.9	25.2	22.0
	4	47.1	40.7	36.4	30.8	27.0
Models 8509 & 8510 Type L Copper Tube	3/4	2.4	2.3	2.2	2.1	1.9
	1	4.0	3.7	3.5	3.2	2.9
	1-1/4	5.7	5.2	4.9	4.3	3.9
	1-1/2	7.5	6.8	6.2	5.4	4.9
	2	10.0	9.0	8.3	7.2	6.5
	2-1/2	13.9	12.2	10.9	9.4	8.3
	3	16.8	14.7	13.2	11.2	9.9
	4	20.6	18.3	16.6	14.3	12.7

Note: Guide Spacing is center to center measured in feet.



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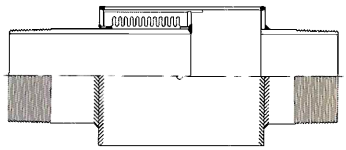
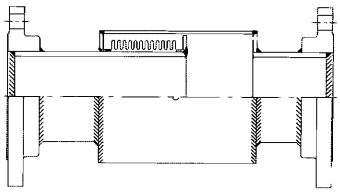
Steel Pipe Applications

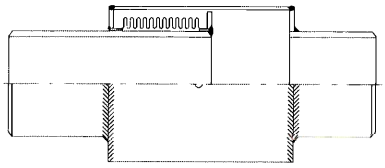
8503 Male Pipe Threads



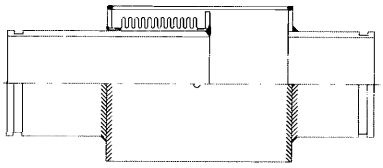
8505 Fixed Flange



8504 Weld End



8506 Grooved Ends

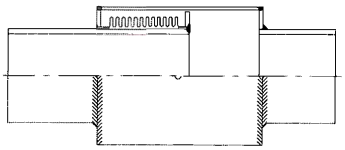


Bellows: Laminated (multiply) ASTM A240 Type 321 stainless steel
Pipe: Schedule 40 ASTM A53 Grade B
Type 8503 threads per ASME B1.20.1
Type 8504 weld prep 37.5° per ASME B16.25
Type 8506 grooved per ANSI/AWWA C606-87
Flanges: ASME A105 raised face dimensioned per ASME B16.5, 150 LB
Housing, Guides & Stops: Carbon steel sheet & tube

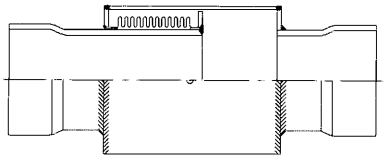
Note: Type 8503 includes an anti-torque stop

Copper Tube End Applications

8509 Male Tube ends



8510 Female Tube Ends



Bellows: Laminated (multiply) ASTM A240
Type 321 stainless steel
Copper Tube: ASTM B88
Housing & Guides: ASTM A240 Type 304 stainless steel

Note: Designed for sweat connection per ASME B16.22

Table 3 Pressure & Force Data

Types 8503, 8504, 8505 & 8506

Part Number 8503,8504 8505,8506	Nominal Size (NPS)	Effective Area (in^2)	Tabulated Pressure Thrust (pounds) 100 (psig)	150 (psig)	200 (psig)	300 (psig)
-214	3/4	1.5	150	225	300	450
-219	1	2.1	210	315	420	630
-224	1-1/4	3.3	330	495	660	990
-227	1-1/2	4.3	430	645	860	1290
-231	2	6.3	630	945	1260	1890
-235	2-1/2	8.8	880	1320	1760	2640
-240	3	13.1	1310	1965	2620	3930
-248	4	20.8	2080	3120	4160	6240
1	2	3	4	5	6	7

Table 4 Pressure & Force Data

Types 8509 & 8510

Part Number 8509 8510	Copper Tube Size	Effective Area (in^2)	Tabulated Pressure Thrust (pounds) 100 (psig)	150 (psig)	200 (psig)	300 (psig)
-212	3/4	1.1	110	165	220	330
-216	1	1.7	170	255	340	510
-220	1-1/4	2.4	240	360	480	720
-223	1-1/2	3.2	320	480	640	960
-229	2	5.1	510	765	1020	1530
-233	2-1/2	7.6	760	1140	1520	2280
-237	3	10.6	1060	1590	2120	3180
-245	4	17.9	1790	2685	3580	5370
1	2	3	4	5	6	7

Note: Tabulated data in Tables 3 & 4 is the force produced by pressure only. Refer to the Axial Spring rate tabulated in Tables 5 & 6 for the force resulting from the bellows stiffness.

Table 5 Steel Pipe Ends, Models 8503, 8504, 8505 and 8506

Design Pressure: 200 psig Test Pressure: 300 psig Temperature Range: -400°F to 500°F

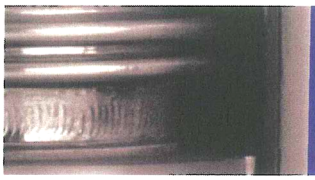
Nominal Size (NPS)	Axial Spring Rate (lb/in)	Outside Diameter (inches)	Part Number	Axial Compr. (inches)	8503, 8504, 8506 Overall Length (inches)	8503, 8504, 8506 Weight (lbs)	8505 Overall Length (inches)	8505 Weight (lbs)
3/4	81 58	2.375	–214-2 –214-3	2.0 3.0	12.750 16.500	2.5 3.0	13.125 16.875	5.0 5.5
1	88 63	2.875	–219-2 –219-3	2.0 3.0	12.750 16.500	4.0 4.7	13.125 16.875	7.5 8.3
1-1/4	75 52	2.875	–224-2 –224-3	2.0 3.0	12.750 16.500	4.5 5.4	13.125 16.875	8.5 9.4
1-1/2	121 82	3.500	–227-2 –227-3	2.0 3.0	14.000 17.500	5.8 6.5	14.375 17.875	10.8 11.5
2	143 117	4.000	–231-2 –231-3	2.0 3.0	14.000 17.500	7.0 8.5	14.375 17.875	15.5 17.0
2-1/2	187 132	5.000	–235-2 –235-3	2.0 3.0	15.500 18.750	12.3 14.8	16.000 19.250	23.5 26.0
3	230 161	5.563	–240-2 –240-3	2.0 3.0	15.500 19.250	15.5 18.5	16.000 19.750	30.0 33.0
4	484 341	6.625	–248-2 –248-3	2.0 3.0	16.375 19.250	21.0 25.0	16.875 19.750	41.0 45.0
1	2	3	4	5	6	7	8	9

Table 6 Copper Tube Ends, Models 8509 and 8510

Design Pressure: 200 psig Test Pressure: 300 psig Temperature Range: -320°F to 500°F

Copper Tube Size	Actual Tube O.D. (inches)	Axial Spring Rate (lb/in)	Outside Diameter (inches)	Part Number	Axial Compr. (inches)	8509, 8510 Overall Length (inches)	8509, 8510 Weight (lbs)
3/4	0.875	82 58	1.500	–212-2 –212-3	2.0 3.0	11.000 14.750	0.8 0.9
1	1.125	89 63	1.875	–216-2 –216-3	2.0 3.0	11.250 15.000	1.1 1.2
1-1/4	1.375	75 54	2.250	–220-2 –220-3	2.0 3.0	12.500 16.250	1.6 1.8
1-1/2	1.625	74 52	2.500	–223-2 –223-3	2.0 3.0	12.875 16.375	1.9 2.1
2	2.125	168 118	3.000	–229-2 –229-3	2.0 3.0	13.187 17.688	3.0 3.3
2-1/2	2.625	159 110	4.000	–233-2 –233-3	2.0 3.0	13.500 16.750	4.0 4.4
3	3.125	251 175	4.500	–237-2 –237-3	2.0 3.0	14.000 17.750	4.5 5.0
4	4.125	341 241	5.563	–245-2 –245-3	2.0 3.0	14.500 18.500	8.4 9.2
1	2	3	4	5	6	7	8

Note: Standard construction is designed for 2" or 3" axial compression and 0.5" axial extension. Refer to Ordering Instructions on Page 6 to order factory preset for axial extension.



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Travel Required

The axial expansion or contraction of pipe or tube is determined by the change in temperature. Table 1 includes a tabulation of linear change in inches for 100 feet of commonly used materials based on an installation temperature of 70°F.

For installation temperature above 70°F subtract the expansion for the installation temperature from the service temperature, and add for installations below 70°F.

The Intermediate Guide Spacing in Table 2 is the minimum recommended guide spacing required to ensure that the pipe or tube travel is translated to and aligned with the compensators.

Important: Hyspan compensators are manufactured with restraints to insure the rated movements. For cold applications or other special conditions the factory must be notified in order to properly preset the units for extension applications.

$$\text{Thermal expansion or contraction (inches)} = \text{Length of run between anchors (feet)} \times \text{Linear change from Table 1} \div 100$$

Anchor Forces

Systems incorporating expansion compensators must include structural reactions or main anchors as shown on the application diagrams (Page 3) with sufficient strength to withstand the full pressure thrust based on the effective area of the compensator, and the spring force produced by deflecting the bellows element.

The highest pressure anticipated during service or testing should be used, and the maximum stroke for the most conservative design.

Ideally, intermediate anchors have balanced forces on each side; however, it is recommended that the maximum force produced by the compensator spring rate should be utilized for design.

$$\text{Main Anchor Force (lbs)} = \text{Pressure Force (lbs) (Table 3 Models 8503-6 or Table 4 Models 8509 &10)} + \{\text{Spring Rate (lb/in) (Column 2 Table 5 Models 8503-6 or Column 3 Table 6 Model 8509 & 10)}\} \times \{\text{Axial Travel (inches)}\}$$

$$\text{Intermediate Anchor Force (lbs)} = \{\text{Spring Rate (lb/in) (Column 2 Table 5 Models 8503-6 or Column 3 Table 6 Model 8509 & 10)}\} \times \{\text{Axial Travel (inches)}\}$$

Ordering Instructions

Refer to Tables 5 & 6 on Page 5 for the steel pipe or copper tube end configuration required for your application. If the travel required is unknown, see the method of calculation above.

Example

Threaded steel pipe ends
200 psig at 500°F maximum
2.0" axial travel maximum
2" NPS

8503-231-2

- 2.0 → Axial travel, 2.0" compression, 0.5" extension
- 2 → Size designation, 2" NPS (Table 5)
- 8503 → Model specification, male pipe thread both ends, steel pipe, steel housing and guides

- Model 8503, 8504, 8505 and 8506 are available with all stainless steel construction for low temperature or highly corrosive service. Must be specified by written description.
- All Series 8500 compensators are available with multiple Alloy 625 bellows for highly corrosive media. Must be specified by written description.

Installation Procedure

Operating Conditions: Series 8500 Expansion Compensators are supplied with a label attached stating the Design Pressure, Test Pressure and Maximum Operating Temperature. Compensators are available for 2" and 3" axial travel. Consult the purchase specification for the allowable travel of the product purchased. Be certain that the system conditions and test conditions do not exceed these values.

Guides, Supports, Anchors: Series 8500 Expansion Compensators are designed for applications where the principal movement is axial to the centerline of the compensator, and the system includes guides, supports and anchors. Refer to Applications on Page 3 for system requirements.

Flow Direction: The flow can be in either direction for Series 8500 Expansion Compensators.

Brazing & Soldering: Type 8509 & 8510 copper tube end compensators incorporate silver brazed joints in the manufacturing process. Do not exceed 1000°F during installation.

Shipping Restraints: External restraints are installed at the factory to insure installation at the correct length and alignment. They are labeled—Shipping Bars, Remove after Installation. Leave these restraints installed until after the installation of the compensator is complete—but they must be removed prior to pressure testing. *CAUTION: they are not designed to react the pressure thrust of the compensator—they must be removed prior to testing. Normally, the shipping restraints are installed by welding and brazing—carefully remove any excess weld or braze metal.*

Post Installation Inspection

1. Inspect the expansion joint for damage.
2. Is the compensator installed at the correct location; and are the anchors, guides and supports installed in accordance with the system design?
3. Are the guides and support free to allow the movement of the compensator?
4. Are the Shipping Restraints removed?

THREE YEAR LIMITED WARRANTY

This warranty is given by HYSPAN PRECISION PRODUCTS, INC. (HYSPAN) for the benefit of the first purchasers for use of its Series 8500 Expansion Compensators manufactured by HYSPAN to standard catalog construction or standard construction with laminated Alloy 625 bellows. The product is warranted to be free from defects in material and workmanship for a period of three (3) years from the date of shipment by HYSPAN in accordance with the following conditions:

1. The design pressure and temperature are not exceeded—including surge and upset conditions.
2. The installation conforms to HYSPAN installation instructions and approved practice for anchoring, supporting and guiding, and generally accepted good piping practice.
3. Substances in contact with all internal and external surfaces must be compatible with the materials of construction, including all contaminates. Steam, condensate, and water containing more than 100 parts per million chlorides are specifically excluded when stainless bellows are used, Inconel bellows construction qualifies.
4. The warranty shall be limited to the replacement by HYSPAN of the same model Series 8500 expansion compensator, and payment for transportation by the least expensive method. Labor, material and other costs related to the failure or replacement of the expansion joint are not included. HYSPAN shall not be liable for damage or delay suffered by the purchaser, regardless of whether such damages are general, special or consequential in nature, whether caused by defective material or workmanship, or whether caused by HYSPAN's negligence regardless of the degree.
5. The warranty is limited to installations in the United States, Puerto Rico and Canada.

The purchaser shall advise the HYSPAN factory of any warranty claim, including the nature of the failure. HYSPAN shall provide return goods authorization and shipping directions to return the failed joint to the factory. A mutually agreeable delivery schedule and method of shipping the replacement shall be established. The purchaser shall furnish a confirming purchase order and is obligated to the current replacement cost of the joint and shipping expense. Upon receipt of the failed product, the cause of failure shall be determined by the factory at no expense to the purchaser. A credit shall be issued by the factory for the replacement cost and least expensive shipping for valid warranty claims. In the event of a dispute, HYSPAN shall furnish the failed product to the purchaser or their representative for failure analysis.

HVAC Products

Industrial Products

Glossary

Technical Assistance

Product Selection

Series 9500
Alignment Guides

Hyspan Series 9500 Alignment Guides are designed to be installed adjacent to expansion joints and loops, and as intermediate guides in steel pipe and copper tube runs to maintain the centerline of the pipe/tube.

Series 9500 Copper Tube Alignment Guide

Pipe or copper tube systems that incorporate expansion joints, ball joints or loops to absorb expansion must include three major elements:main and/or intermediate anchors, supports and alignment guides. Main anchors are required in systems that include unrestrained expansion joints to react pressure thrust, the expansion joint spring or friction force and the friction force of the guides and supports. Intermediate anchors are required in systems where pressure thrust is restrained but the expansion joint or loop spring or friction force and guide and support friction forces must be reacted. Supports must be designed to react the weight of the pipe/tube and media. Alignment guides are required to maintain the pipe/tube centerline axial to expansion joints and throughout the intermediate portion of the run to prevent buckling.

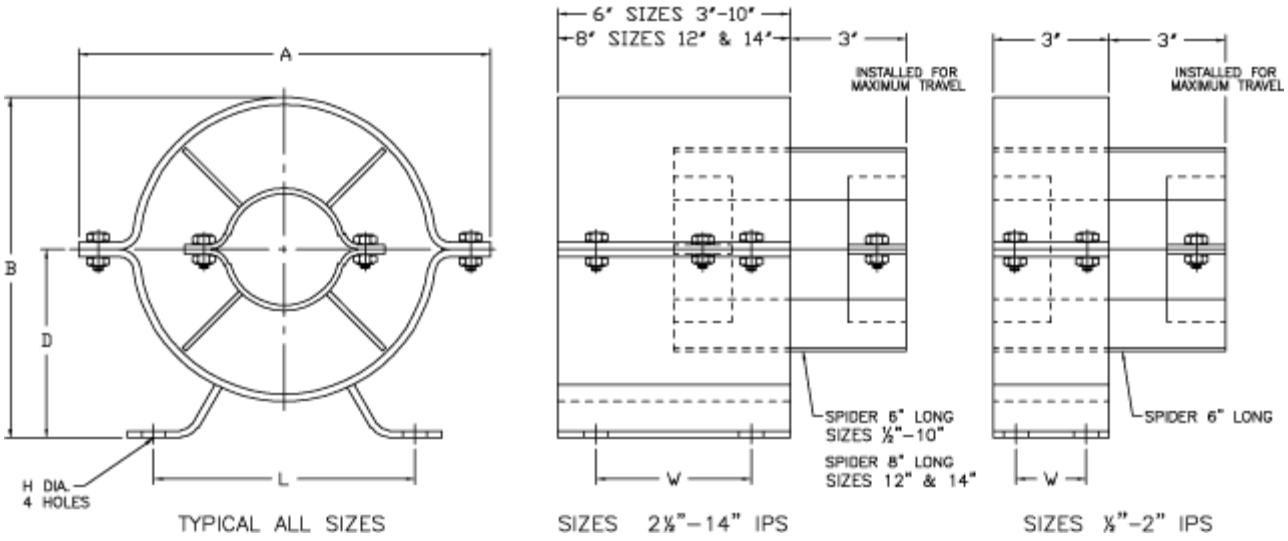
The alignment guides requirements for Hyspan products are given in the Applications section of each product catalog. These requirements follow the Standards of the Expansion Joint Manufactures Association, Inc. Expansion joints that do not include internal guides require an alignment guide to be located 4 diameters from the face of the expansion joint, and an additional guide 14 diameters from the first guide. Expansion joints with internal guides require only one alignment guide to be located 10-14 diameters from the expansion joint.

The maximum alignment guide spacing in the intermediate portion of the run is a function of the pipe/tube properties (modulus of elasticity and moment of inertia), the design pressure, and the expansion joint effective area and spring force. Refer to the Applications section of Hyspan expansion joint catalogs for the individual product guiding requirements.

- Series 1500 Laminated Bellows Expansion Joints
  - Applications
  - Intermediate Guides
- Series 3500 Externally Pressurized Expansion Joints
  - Applications
  - Intermediate Guides
- Series 6500 Packed Expansion joints
  - Applications
  - Intermediate Guides
- Series 8500 Expansion Compensators
  - Applications
  - Intermediate Guides

Pipe Alignment Guides

Hyspan manufactures and inventories standard alignment guides for nominal pipe size (NPS) steel pipe from 3/4” through 14” with varying insulation thickness. Construction is heavy gauge pressed steel with precision drilled bolting. All surfaces are coated with a protective black enamel paint. The maximum operating temperature is 500°F.

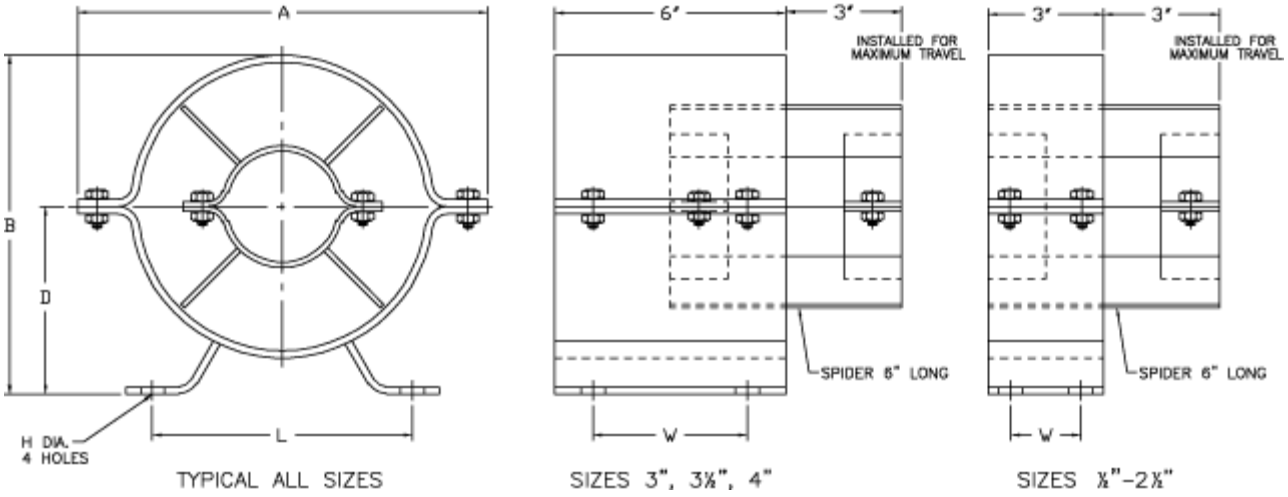


Nominal Pipe Size (NPS)	Part Number	Insulation Thickness (inches)	Pipe Expansion (inches)	Centerline Height, D (inches)	Dimensions (inches) A	B	L	W	H	Weight (lbs)
3/4	9514-1	1.5	3	3.50	8.44	6.34	7.06	1.5	.625	8
	9514-2	2.0	3	3.88	9.50	7.25	7.81	1.5	.625	9
	9514-4	2.5	6	4.88	10.63	8.81	6.75	4.0	.625	14
	9514-5	3.5	6	5.50	12.13	10.19	7.50	4.0	.625	17
	9514-6	4.0	6	6.50	13.75	12.00	7.16	4.0	.625	20
1	9519-1	1.5	3	3.50	8.44	6.34	7.06	1.5	.625	8
	9519-2	2.0	3	3.88	9.50	7.25	7.81	1.5	.625	9
	9519-4	2.5	6	4.88	10.63	8.81	6.75	4.0	.625	14
	9519-5	3.5	6	5.50	12.13	10.19	7.50	4.0	.625	17
	9519-6	4.0	6	6.50	13.75	12.00	7.16	4.0	.625	20
1 1/4	9524-2	1.5	3	3.88	9.50	7.25	7.81	1.5	.625	9
	9524-4	2.5	6	4.88	10.63	8.81	6.75	4.0	.625	14
	9524-5	3.0	6	5.50	12.13	10.19	7.50	4.0	.625	17
	9524-6	4.0	6	6.50	13.75	12.00	7.16	4.0	.625	20
1 1/2	9527-2	1.5	3	3.88	9.50	7.25	7.81	1.5	.625	9
	9527-4	2.0	6	4.88	10.63	8.81	6.75	4.0	.625	14
	9527-5	3.0	6	5.50	12.13	10.19	7.50	4.0	.625	17
	9527-6	4.0	6	6.50	13.75	12.00	7.16	4.0	.625	20
2	9531-2	1.5	3	3.88	9.50	7.25	7.81	1.5	.625	9
	9531-4	2.0	6	4.88	10.63	8.81	6.75	4.0	.625	14
	9531-5	2.5	6	5.50	12.13	10.19	7.50	4.0	.625	17
	9531-6	3.5	6	6.50	13.75	12.00	7.16	4.0	.625	20
	9531-7	5.0	6	8.50	17.38	15.56	11.00	4.0	.750	35
2 1/2	9535-4	1.5	6	4.88	10.63	8.81	6.75	4.0	.625	14
	9535-5	2.5	6	5.50	12.13	10.19	7.50	4.0	.625	17
	9535-6	3.5	6	6.50	13.75	12.00	7.16	4.0	.625	20
	9535-7	4.5	6	8.50	17.38	15.56	11.00	4.0	.750	35
3	9540-4	1.5	6	4.88	10.63	8.81	6.75	4.0	.625	14
	9540-5	2.0	6	5.50	12.13	10.19	7.50	4.0	.625	17
	9540-6	3.0	6	6.50	13.75	12.00	7.16	4.0	.625	20
	9540-7	4.5	6	8.50	17.38	15.56	11.00	4.0	.750	35
4	9548-5	1.5	6	5.50	12.13	10.19	7.50	4.0	.625	17
	9548-6	2.5	6	6.50	13.75	12.00	7.16	4.0	.625	20
	9548-7	4.0	6	8.50	17.38	15.56	11.00	4.0	.750	35
5	9555-6	1.5	6	6.50	13.75	12.00	7.16	4.0	.625	20
	9555-7	3.5	6	8.50	17.38	15.56	11.00	4.0	.750	35

	9555-8	4.5	6	9.75	19.50	17.88	11.00	4.0	.750	40
6	9560-6	1.5	6	6.50	13.75	12.00	7.16	4.0	.625	20
	9560-7	2.5	6	8.50	17.38	15.56	11.00	4.0	.750	35
	9560-8	4.0	6	9.75	19.50	17.88	11.00	4.0	.750	40
8	9567-7	2.0	6	8.50	17.38	15.56	11.00	4.0	.750	35
	9567-8	3.0	6	9.75	19.50	17.88	11.00	4.0	.750	40
	9567-9	4.5	6	12.00	22.75	21.75	13.00	6.0	.750	55
10	9574-8	2.0	6	9.75	19.50	17.88	11.00	4.0	.750	40
	9574-9	3.5	6	12.00	22.75	21.75	13.00	6.0	.750	55
	9574-10	4.5	8	13.50	25.00	24.38	13.00	6.0	.875	60
12	9580-9	2.0	6	12.00	22.75	21.75	13.00	6.0	.750	55
	9580-10	4.0	8	13.50	25.00	24.38	13.00	6.0	.875	60
14	9581-9	2.0	6	12.00	22.75	21.75	13.00	6.0	.750	55
	9581-10	3.5	8	13.50	25.00	24.38	13.00	6.0	.875	60
1	2	3	4	5	6	7	8	9	10	11

Copper Tube Alignment Guides

Hyspan manufactures and inventories standard alignment guides for standard size copper tube from 3/4” through 4” with varying insulation thickness. Construction is heavy guage pressed steel with precision drilled bolting. All surfaces are coated with a protective black enamel paint. The interface with the copper tube is coated with a permanent heavy dielectric material. The maximum operating temperature is 400°F.



Copper Tube Size	Actual Tube OD (inches)	Part Number	Insulation Thickness (inches)	Tube Expansion (inches)	Centerline Height, D (inches)	Dimensions (inches) A	B	L	W	H	Weight (lbs)
3/4	7/8	9512-1	1.5	3	3.50	8.44	6.34	7.06	1.5	.625	8
		9512-2	2.0	3	3.88	9.50	7.25	7.81	1.5	.625	9
		9512-4	2.5	6	4.88	10.63	8.81	6.75	4.0	.625	14
		9512-5	3.5	6	5.50	12.13	10.19	7.50	4.0	.625	17
		9512-6	4.5	6	6.50	13.75	12.00	7.16	4.0	.625	20
1	1 1/8	9516-1	1.5	3	3.50	8.44	6.34	7.06	1.5	.625	8
		9516-2	2.0	3	3.88	9.50	7.25	7.81	1.5	.625	9
		9516-4	2.5	6	4.88	10.63	8.81	6.75	4.0	.625	14
		9516-5	3.5	6	5.50	12.13	10.19	7.50	4.0	.625	17
		9516-6	4.0	6	6.50	13.75	12.00	7.16	4.0	.625	20
1 1/4	1 3/8	9520-1	1.5	3	3.50	8.44	6.34	7.06	1.5	.625	8
		9520-2	2.0	3	3.88	9.50	7.25	7.81	1.5	.625	9
		9520-4	2.5	6	4.88	10.63	8.81	6.75	4.0	.625	14
		9520-5	3.0	6	5.50	12.13	10.19	7.50	4.0	.625	17

		9520-6	4.0	6	6.50	13.75	12.00	7.16	4.0	.625	20
1 1/2	1 5/8	9523-1	1.5	3	3.50	8.44	6.34	7.06	1.5	.625	8
		9523-2	2.0	3	3.88	9.50	7.25	7.81	1.5	.625	9
		9523-4	2.5	6	4.88	10.63	8.81	6.75	4.0	.625	14
		9523-5	3.0	6	5.50	12.13	10.19	7.50	4.0	.625	17
		9523-6	4.0	6	6.50	13.75	12.00	7.16	4.0	.625	20
2	2 1/8	9529-2	1.5	3	3.88	9.50	7.25	7.81	1.5	.625	9
		9529-4	2.0	6	4.88	10.63	8.81	6.75	4.0	.625	14
		9529-5	3.0	6	5.50	12.13	10.19	7.50	4.0	.625	17
		9529-6	3.5	6	6.50	13.75	12.00	7.16	4.0	.625	20
		9529-7	5.0	6	8.50	17.38	15.53	11.00	4.0	.750	35
2 1/2	2 5/8	9533-2	1.5	3	3.88	9.50	7.25	7.81	1.5	.625	9
		9533-4	2.0	6	4.88	10.63	8.81	6.75	4.0	.625	14
		9533-5	2.5	6	5.50	12.13	10.19	7.50	4.0	.625	17
		9533-6	3.5	6	6.50	13.75	12.00	7.16	4.0	.625	20
		9533-7	4.5	6	8.50	17.38	15.53	11.00	4.0	.750	35
3	3 1/8	9537-4	1.5	6	4.88	10.63	8.81	6.75	4.0	.625	14
		9537-5	2.5	6	5.50	12.13	10.19	7.50	4.0	.625	17
		9537-6	3.0	6	6.50	13.75	12.00	7.16	4.0	.625	20
		9537-7	4.5	6	8.50	17.38	15.53	11.00	4.0	.750	35
4	4 1/8	9545-5	2.0	6	5.50	12.13	10.19	7.50	4.0	.625	17
		9545-6	2.5	6	6.50	13.75	12.00	7.16	4.0	.625	20
		9545-7	4.0	6	8.50	17.38	15.53	11.00	4.0	.750	35
1	2	3	4	5	6	7	8	9	10	11	12

Home | **About Hyspan** | **Contact Us** |
Ordering Instructions & Terms of Sale | **Site Map** | **Back to Top**

ITW Insulation Systems

Temperlite® 1200° Perlite Thermal Insulation

Temperlite® 1200° is a rigid, high temperature, water resistant molded perlite thermal insulation available in block, pipe or molded fitting form. The product is a light gray material with dark heat stabilized flecks throughout the product for easy identification as an insulation which **does not contain asbestos**.

Applications

The product has an application temperature range up to 1200° F, even under cyclic condition. Its unique water resistant formulation makes it especially suitable for those applications up to 600° F where water incursion is a consideration and where cellular glass or other foam insulation have previously been the only viable option. The product is naturally high in silicates, making it the preferred choice for those applications where stress corrosion is a consideration. Because the material is resistant to moisture, it does not contribute to premature corrosion of protective jacketing system.
For additional information, visit www.itwinsulation.com, call 1-800-231-1024 or contact your local ITW representative.

Features and Benefits

Moisture Resistance:

At temperatures up to 600° F, **Temperlite®** 1200° is extremely resistant to water absorption. Mechanical strength and thermal performance are preserving and the insulation will not act as a reservoir for jacket corrosion as is common with many other rigid insulations.

Corrosion Resistance:

Because **Temperlite®** 1200° is high in silicates and non-wicking, it will, not cause or promote stress corrosion cracking of austenitic stainless steel.

Thermal Performance:

Temperlite® 1200° provides excellent thermal insulating properties throughout its full range of use. This thermal efficiency results in reliable temperature control for critical process operations.

Fire Resistance:

Temperlite® 1200° will not burn or carry flame. It has a flame spread of zero and smoke developed of zero when tested per ASTM E 84.

Heat Stability:

Unlike some other rigid insulation, **Temperlite®** 1200° will maintain its integrity and insulating efficiency even under conditions of soaking heat up to its full 1200° F recommended operating range.

Rigidity:

Temperlite® 1200° is designed and manufactured to provide strength required to withstand personnel traffic and other common installation and application abuses.

Ease of fabrication:

Temperlite® 1200° cuts easily and cleanly, minimizing fabrication time in the field and prolonging fabrication equipment life.

Specification Compliance:

ASTM C 610 Type II "Standard Specification for Expanded Perlite Block and pipe Thermal Insulation".
ASTM C 795 " Standard Specification for Wicking-Type Thermal Insulation for Use Over Austenitic Stainless Steel.
MIL-I-24244C (SH) "Insulation Material with Special Corrosion: Chloride, and Fluoride Requirements".
NRC Reg. Guide 1.36 "Nonmetallic Thermal Insulation for Austenitic Stainless Steel".
DuPont "Dana" Accelerated Stress Corrosion Test after 700°F Soaking Heat
USCG 164.009/308/0 “Noncombustible Material".

*Waiver required on tumbling friability.

Temperlite 1200° Perlite Thermal Insulation

Physical Properties of Temperlite* 1200° Perlite Thermal Insulation

Property	Test Method	Value	
Density	ASTM C 303	12.0-14 pcf	
Water Absorption	ASTM C 209	2 hrs: 1.2% max	
Flexural Strength	ASTM C 203	48-56 psi	
Compressive Strength (5 % deformation)	ASTM C 165	60-70 psi	
Linear Shrinkage (1200°F for 24 hrs)	ASTM C 356	2 % max	
Surface Burning Characteristics	ASTM E 84	Flame Spread 0 Smoke Developed 0	
Acid Resistance	7 days-10 % HCl	No visible change	
	7 days-10 % H2SO4	No visible change	
	24 hrs-25 % HCl	No visible change	
	24hrs-25 % H2SO4	No visible change	
pH	MIL-I-24244C (SH)	10.4-10.7	
Thermal Conductivity	ASTM C 177	Mean Temperature °C (°F)	K Factor; in units SI units W/m-°K (Btu-in/hr Ft2 °F)
		93 (200) 150 (301) 205 (400) 261 (501) 316 (602) 371 (701)	0.072 (0.500) 0.080 (0.556) 0.088 (0.610) 0.093 (0.646) 0.101 (0.702) 0.108 (0.74)

- **For Technical Information: 1-800-231-1024**
- **For Sales Information: 1-800-231-1024**
- ITW Insulation Systems
- 1370 East 40th Street, Building 7, Suite 1
- Houston, TX 77022-4104
- **www.itwinsulation.com**

ITW Insulation Systems

MATERIAL SAFETY DATA SHEET

SECTION 1 - PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: Temperlite® 1200°
PART NUMBER:
GENERAL USE: Expanded perlite block and pipe covering
PRODUCT DESCRIPTION: A sodium potassium aluminum silicate of variable composition

ITW Insulation Systems

MANUFACTURER'S NAME ITW Insulation Systems	DATE PREPARED: December 2, 2008 SUPERSEDES: May 23, 2007, March 27, 2004	Page 1 of 4
ADDRESS (NUMBER, STREET, P.O. BOX) Carr. Monterrey-Saltillo Km. 65 No. 1005	TELEPHONE NUMBER FOR INFORMATION (52) 81-8390-0015	
(CITY, STATE AND ZIP CODE) Santa Catarina, Nuevo Leon 66350 COUNTRY Mexico	EMERGENCY TELEPHONE NUMBER (52) 81-8390-0015	
DISTRIBUTOR'S NAME Same		
ADDRESS (NUMBER, STREET, P.O. BOX)	TELEPHONE NUMBER FOR INFORMATION	
(CITY, STATE AND ZIP CODE) COUNTRY	EMERGENCY TELEPHONE NUMBER	

SECTION 2 - HAZARDOUS INGREDIENTS

HAZARDOUS COMPONENTS	% (by weight)	CAS #	EINECS #	Hazard Symbol	RISK PHRASES Full Text Section 16
Mineral Silicates	> 98	Not specified	Not specified	Xi	R-36/37
Silica, crystalline, quartz (a,b)	< 0.05	14808-60-7	238-878-4	Xn	R-20, 36/37, 40

(a) Indicates substance appears on National Toxicology Program (NTP) list of carcinogens, International Agency for Research on Cancer (IARC) list of carcinogens or is regulated by the Occupational Safety and Health Administration (OSHA) as a possible carcinogen.

(b) California Prop 65, Safe Drinking Water and Toxic Enforcement Act of 1986, chemicals known to the state to cause cancer or reproductive toxicity. A person in the course of doing business must warn others who may consume, come into contact with, or otherwise be exposed to this chemical.

SECTION 3 - HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Airborne dust particles are harmful and irritating to respiratory tract. Contact with eyes may cause irritation. This product may contain trace amounts of crystalline silica which is considered a chronic health hazard by inhalation. The International Agency for Research on Cancer (IARC) has classified occupational exposures to respirable crystalline silica as being carcinogenic to humans (Class 1). This classification is based on what IARC considered sufficient evidence from epidemiological studies of humans for the carcinogenicity of inhaled silica in the forms of quartz and cristobalite. Crystalline silica is also known to cause Silicosis, a non-cancerous lung disease. Hazard symbols for this product: Xi. Risk Phrases - R20, 36/37

POTENTIAL HEALTH EFFECTS

INHALATION: Breathing airborne particles or dust from mixing, spraying, sanding, grinding, etc. may cause irritation to respiratory tract. Long term overexposure to respirable crystalline silica dust may cause permanent and irreversible lung damage including silicosis. Contains substances which are considered nuisance dusts which require a NIOSH approved respirator when airborne particulate exceeds maximum allowable limit.

SKIN: None expected, however, prolonged contact may cause irritation.

EYES: Contact with eyes may cause irritation.

INGESTION: May cause gastric distress, stomach pains, vomiting and diarrhea.

CARCINOGENICITY NTP? No MONOGRAPHS? No OSHA REGULATED? No

The International Agency for Research on Cancer (IARC) has classified occupational exposures to respirable crystalline silica as being carcinogenic to humans (Class 1).

SECTION 4 - FIRST AID MEASURES

INHALATION: Remove affected person to fresh air; if symptoms persist seek medical attention.

SKIN: Wash contacted area with soap and water; if irritation persists, seek medical attention.

EYES: Remove contact lenses. Flush eyes with clear running water for 15 minutes while holding eyelids open; if irritation persists, seek medical attention.

INGESTION: Give two glasses of water for dilution; DO NOT induce vomiting; never give anything by mouth to an unconscious person; seek medical attention.

SECTION 5 - FIRE FIGHTING MEASURES

GENERAL HAZARDS: Product is not considered flammable or combustible. Other surrounding products involved in a fire may release compounds of carbon, hydrogen and oxygen, including carbon monoxide.

EXTINGUISHING MEDIA
Carbon dioxide, water, water fog, dry chemical, chemical foam.

FIRE FIGHTING PROCEDURES
None

UNUSUAL FIRE AND EXPLOSION HAZARDS
None

HAZARDOUS COMBUSTION PRODUCTS
Smoke, fumes, oxides of carbon.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Recover and segregate product for reuse; shovel product into approved container for disposal. Do not discharge into lakes, ponds, streams or public waters.

SECTION 7 - HANDLING AND STORAGE

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep container closed when not in use; protect containers from abuse; store containers in cool, dry area. Keep this and other chemicals out of reach of children.

SECTION 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION

HAZARDOUS COMPONENTS	NIOSH				ACGIH			
	TWA ppm	TWA mg/m3	STEL ppm	STEL mg/m3	TWA ppm	TWA mg/m3	STEL ppm	STEL mg/m3
Mineral Silicates	-	3	-	5	-	3	-	5
Silica, crystalline, quartz (a,b)	-	0.05	-	-	-	0.05	-	-

PERSONAL PROTECTION:

RESPIRATORY PROTECTION (SPECIFY TYPE): NIOSH approved respirator designed to remove airborne particulate present in excess of maximum allowable concentrations due to secondary operations such as mixing, spraying, sanding, buffing, etc. Refer to 29 CFR 1910.134 or European Standard EN 149 for regulations.

PROTECTIVE GLOVES: Neoprene or nitrile rubber gloves.

EYE PROTECTION: Protective eyeglasses or chemical safety goggles. Refer to 29 CFR 1910.133 or European Standard EN166.

OTHER PROTECTIVE CLOTHING OR EQUIPMENT: Safety eyewash station nearby.

WORK / HYGIENIC PRACTICES: Practice safe workplace habits. Minimize body contact with this, as well as all chemicals in general.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE AND ODOR Solid, off white slid of variable size. No characteristic odor.	VAPOR PRESSURE Not applicable
pH Not applicable	SPECIFIC GRAVITY (WATER = 1) 0.2
BOILING POINT / BOILING RANGE Not applicable	SOLUBILITY IN WATER Negligible
FLASH POINT Non-flammable	VISCOSITY Solid
FLAMMABLE LIMITS LEL: Not applicable UEL: Not applicable	VAPOR DENSITY (AIR = 1) Not applicable
AUTOIGNITION TEMPERATURE Not determined	EVAPORATION RATE (WATER = 1) Not applicable

SECTION 10 - STABILITY AND REACTIVITY

STABILITY UNSTABLE: STABLE: X	CONDITIONS TO AVOID: Avoid generating airborne dust.

INCOMPATIBILITY (MATERIALS TO AVOID): Strong oxidizers, strong acids.

HAZARDOUS DECOMPOSITION OR BYPRODUCTS: Decomposition will not occur if handled and stored properly. In case of a fire, oxides of carbon, hydrocarbons, fumes, and smoke may be produced.

HAZARDOUS POLYMERIZATION MAY OCCUR: WILL NOT OCCUR: X	CONDITIONS TO AVOID: None

SECTION 11 - TOXICOLOGICAL INFORMATION

Hazardous Components	CAS # EINECS #	LD50 of Ingredient (Specify Species and Route)	LC50 of Ingredient (Specify Species)
Mineral Silicates	Not specified Not specified	Not established	Not established
Silica, crystalline, quartz (a,b)	14808-60-7 238-878-4	Not established	Not established

SECTION 12 - ECOLOGICAL INFORMATION

No data are available on the adverse effects of this material on the environment. Neither COD nor BOD data are available. Based on the chemical composition of this product it is assumed that the mixture can be treated in an acclimatized biological waste treatment plant system in limited quantities. However, such treatment should be evaluated and approved for each specific biological system. None of the ingredients in this mixture are classified as a Marine Pollutant.

SECTION 13 - DISPOSAL CONSIDERATIONS

WASTE DISPOSAL METHOD: According to the European Waste Catalogue, waste codes are application specific and should be assigned by the user based on the application for which the product is used. Dispose of in accordance with Local, State, and Federal Regulations, do not discharge into lakes, ponds, streams or public waters. Product is classified as non - hazardous, however, non-hazardous materials may become hazardous waste upon contact with other products. Refer to "40 CFR Protection of Environment Parts 260 - 299" for complete waste disposal regulations. Consult your local, state, or Federal Environmental Protection Agency before disposing of any chemicals.

SECTION 14 - TRANSPORT INFORMATION

PROPER SHIPPING NAME: Not regulated

DOT HAZARD CLASS / Pack Group: Not regulated	IATA HAZARD CLASS / Pack Group: Not Regulated
REFERENCE: Not Applicable	IMDG HAZARD CLASS: Not regulated
UN / NA IDENTIFICATION NUMBER: None	RID/ADR Dangerous Goods Code: Not regulated
LABEL: None Required	UN TDG Class / Pack Group: Not regulated
HAZARD SYMBOLS: None	Hazard Identification Number (HIN): None

Note: Transportation information provided is for reference only. Client is urged to consult CFR 49 parts 100 - 177, IMDG, IATA, EU, United Nations TDG, and WHMIS (Canada) TDG information manuals for detailed regulations and exceptions covering specific container sizes, packaging materials and methods of shipping.

SECTION 15 - REGULATORY INFORMATION

TSCA (USA - Toxic Substance Control Act)
All components of this product are listed on the U.S. Toxic Substances Control Act Chemical Inventory (TSCA Inventory) or are exempted from listing because a Low Volume Exemption has been granted in accordance with 40 CFR 723.50.

SARA TITLE III (USA - Superfund Amendments and Reauthorization Act)
311/312 Hazard Categories
None

313 Reportable Ingredients:
None

CERCLA (USA - Comprehensive Response Compensation and Liability Act)
None

California Prop 65, Safe Drinking Water and Toxic Enforcement Act of 1986 There is a reportable chemical present (crystalline silica) known to the state of California to cause cancer or reproductive toxicity.

CPR (Canadian Controlled Products Regulations)
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all the information required by the Controlled Products Regulations. WHMIS Classification: D2B

IDL (Canadian Ingredient Disclosure List)
Components of this product identified by CAS number and listed on the Canadian Ingredient Disclosure List are shown in Section 2.

DSL / NDSL (Canadian Domestic Substances List / Non-Domestic Substances List)
Components of this product identified by CAS number are listed on the DSL or NDSL and may or may not be listed in Section 2 of this document. Only ingredients classified as "hazardous" are listed in Section 2 unless otherwise indicated.

EINECS (European Inventory of Existing Commercial Chemical Substances)
Components of this product identified by CAS numbers are on the European Inventory of Existing Commercial Chemical Substances.

WGK Water Quality Index: 1 VbK Index: Not applicable

RISK PHRASES:	SYMBOL(S) REQUIRED FOR LABEL	SAFETY PHRASES:
R20 Harmful by inhalation. R36/37 Irritating to eyes and respiratory system.	Irritating 	S22 Do not breathe dust. S25 Avoid contact with eyes.

SECTION 16 - OTHER INFORMATION

Notes & full R-Phrase text	R20 Harmful by inhalation. R36/37 Irritating to eyes and respiratory system. R40 Limited evidence of a carcinogenic effect.

HMIS HAZARD RATINGS HEALTH 1 * = Chronic Health Hazard 2 = MODERATE
FLAMMABILITY 0 0 = INSIGNIFICANT 3 = HIGH
PHYSICAL HAZARD 0 1 = SLIGHT 4 = EXTREME
PERSONAL PROTECTIVE EQUIPMENT E Safety Glasses, Gloves, Dust Respirator

REVISION SUMMARY:
This MSDS has been revised in the following sections: Section 16, HMIS text

MSDS Prepared by: Comprehensive Data Base, Inc.
P.O. Box 395
Intercession City, FL 33848 USA
(863) 644 - 3298 www.compdatabase.com or www.msds.cc

Industrial Insulation Group, LLC
A Calsilite/Johns Manville Joint Venture

Thermo-12® Gold

Pipe & Block Insulation

XOX® Corrosion Inhibitor

Description

Thermo-12 Gold is a pre-formed, high temperature, abuse-resistant pipe and block insulation with exceptional structural strength, composed of hydrous calcium silicate for use on systems operating from 80ºF (26.7°C) to 1200°F (649°C). It is inorganic, non-combustible, asbestos-free and meets or exceeds the physical and thermal property requirements of ASTM C533, Type 1. Integral to Thermo-12 Gold is XOX, a distinctive formula and process that inhibits corrosion to outside surfaces of pipe and equipment.

Applications

Because of its low thermal conductivity, durability, compressive strength and corrosion inhibiting properties, it is the preferred product for application on high temperature piping and equipment. Thermo-12 Gold is especially recommended for use in the petrochemical, power generation and process industries where piping and equipment are cycled from 80ºF (26.7°C) to 1200°F (649°C). The XOX corrosion inhibiting properties are not diminished by heating and cooling so the corrosion protection will continue for the life of the product. Thermo-12 Gold will not burn and may be used for fire protection in some applications. Please e-mail info@iig-llc.com for specific application information.

IIG SAFETY:
Personnel • Process • Planet

Advantages

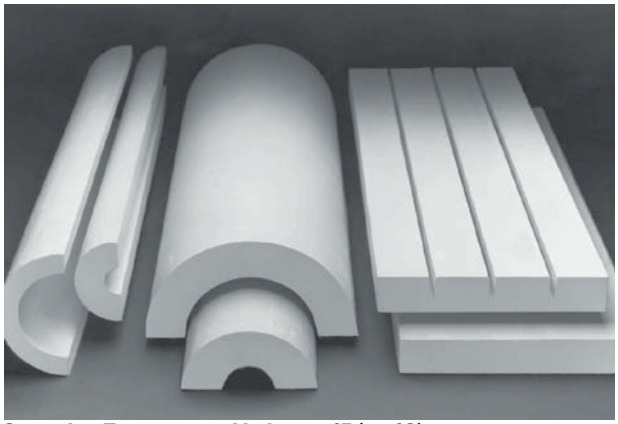
- Guards pipe and equipment surfaces against corrosion
- Excellent resistance to breakage and physical abuse
- No binders to burn out; No loss of insulation integrity.
- Excellent thermal performance to 1200°F
  Superior thermal performance from 450°F to 1200°F
- Resistant to mold growth
- Fast, easy installation
- Large selection of sizes and forms

Available Forms and Sizes

Pipe Sizes		Thermo-12 Gold Form
in.	mm	
½ - 24	15 - 600	Pipe Insulation
20 - 37	500 - 925	Quad Segments
38 - 52	950 - 1300	Hex Pipe Covering (Ruston Plant Only)
30 - 250+	750 - 6350+	Scored Block [12" (305 mm) wide] [18" (mm) wide (Mesa Plant Only)]
Flat Surfaces		Flat Block [6", 12" and 18" wide (152 mm, 305 mm and 457 mm wide)]

Thermo-12 Gold pipe insulation is 36" (914 mm) in length, and is available in thicknesses from 1" to 6" (25 mm to 150 mm) in ½" (15 mm) increments. Thick wall material is furnished in double layers.

Thermo-12 Gold flat block insulation is 12" (305 mm) wide and 36" (914 mm) in length, and is available in thicknesses from 1" to 4" (25 mm to 100 mm) in ½" (15 mm) increments. Non-standard widths of 18", 24" and 36" (457 mm, 610 mm and 914 mm) are available on a made-to-order basis. Inquire for price and availability.



Operating Temperature Limit: 1200ºF (649ºC)

Scored Block Application Guide

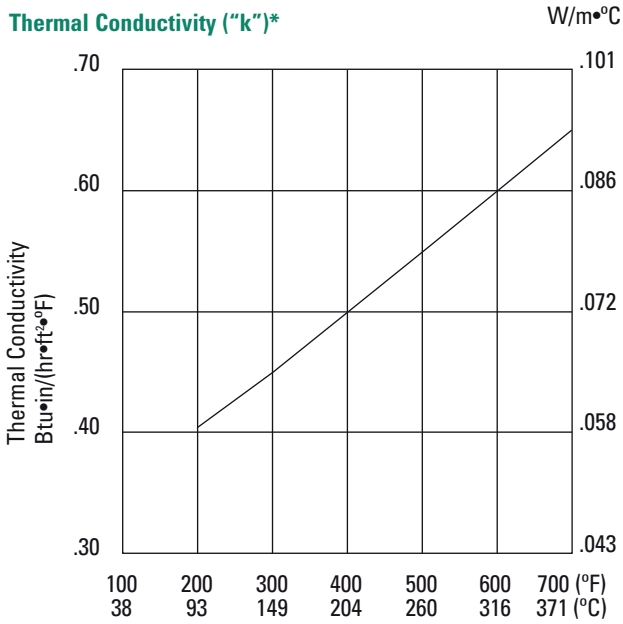
Insulation Thickness		Minimum Diameter Triple Scored	
in.	mm	in.	mm
1½	38	30	762
2	51	40	1016
2½	64	50	1270
3	76	60	1524
3½	89	70	1778
4	102	80	2032

Fire Safety

Surface Burning Characteristics. When tested in accordance with ASTM E 84, NFPA 255, and UL 723, Thermo-12 Gold has flame spread/smoke developed ratings of 0/0.

Hot Surface Performance. Thermo-12 Gold passes ASTM C 411 to 1200°F (649°C).

Thermal Conductivity ("k")*



Mean Temperature	˚F	200	300	400	500	600	700
	˚C	93	149	204	260	316	371
Btu•in/(hr•ft²•˚F)		.41	.45	.50	.55	.60	.65
W/m•˚C		.059	.065	.072	.079	.086	.094

* Thermo-12 Gold Pipe & Block Insulation as tested in accordance with ASTM C 177 and ASTM C 335.

Thermo-12® Gold

Pipe & Block Insulation

Specification Compliance

ASTM C 533, Type I
ASTM C 795
ASTM C 1338
ASTM E 136 (Noncombustible)
MIL-I-24244
MIL-I-2781F to 1200°F (649°C) [Pipe]
MIL-I-2819F Class 2 to 1200°F (649°C) [Block]
NRC Reg. Guide 1.36

Physical Property Requirements
ASTM C 533, Type I

Density (Dry) Average ..... 14.5 lbs. per cu. ft.
ASTM C 302 (232 kg/m³)

Flexural Strength ..... 65 psi (448 kPa)
ASTM C 203

Compressive Strength ..... 100 psi (690 kPa)
ASTM C 165 to Produce 5% Compression

Abrasion Resistance ..... After First 10 Min. - 15
(% Weight Loss by Tumbling) After Second 10 Min. - 30
ASTM C 421

Linear Shrinkage ..... Less Than 2 .0% After 24-hr.
ASTM C 356 Soaking Period at
1200°F (649°C)

Max. Service Temperature ..... 1200°F (649°C)
ASTM C 411

Mold Growth ..... Does Not Support
ASTM C 1338

Surface Burning Characteristics ..... Flame Spread - 0
ASTM E 84 Smoke Developed - 0

Government Certification

When ordering material that requires Certificate of Conformance to ASTM, government, or other specifications, a statement of the fact must appear on the purchase order. These specifications require specific lot testing and prohibit the certification of the lot after the shipment has been made. There may be additional charges associated with compliance testing. Refer to customer service for more information.

For Customer Service and Order Placement
(800) 866-3234
Fax: (318) 255-5821

For Sales Information
(800) 866-3234
Fax: (866) 325-8180

For Technical Information
(800) 872-0338
Fax: (866) 384-9338

Industrial Insulation Group, LLC.
2100 Line Street
Brunswick, GA 31520
www.iig-llc.com

The physical and chemical properties of the Thermo-12 Gold Pipe and Block Insulation presented herein represent typical, average values obtained in accordance with accepted test methods and are subject to normal manufacturing variations. They are supplied as a technical service and are subject to change without notice. Any references to numerical flame spread or smoke developed ratings are not intended to reflect hazards presented by these or any other materials under actual fire conditions. Check with the Customer Service Office to assure current information. **All Industrial Insulation Group products are sold subject to the IIG Limited Warranty and Limitation of Remedy. For a copy of the IIG Limited Warranty and Limitation of Remedy, email - info@iig-llc.com**.

IIG-300 7-07 (Replaces 2-05)

Industrial Insulation Group
A Calsilite/Johns Manville Joint Venture

Date: 8/31/2005
MSDS ID: 20501
Rev: 1.0.4
Replaces: 10/6/2003

Material Safety Data Sheet

Material Name: Calcium Silicate Insulation

Section 1— Chemical Product and Company Identification

Product Name: Thermo-12® Gold Calcium Silicate Insulation
CAS# Mixture/None Assigned
Generic Name: Insulation (Calcium Silicate)
Formula: Mixture
Chemical Name: Synthetic Calcium Silicate

Manufacturer Information
Industrial Insulation Group
2100 Line Street
Brunswick, GA. 31520

Phone number for Health and Safety Information: 970.858.6211 (M-F, 7:00a.m. to 4:00p.m., Mountain Time)

Trade Name: Thermo-12 Gold

Section 2 — Composition and Information on Ingredients

CAS #	Component	Percent	OSHA PEL	ACGIH TLV	NIOSH REL	UNITS
1344-95-2	Synthetic Calcium Silicate	> 93	15(T) 5(R)	10	10(T) 5(R)	mg/M^3
51274-00-1	Iron-based color	< 1	15(T) 5(R)	10	NE	mg/M^3
65997-17-3	Synthetic Vitreous Fiber	0 - 2	15(T) 5(R)	5	5	mg/M^3
9004-34-6	Cellulose Fiber	0 - 2	15(T) 5(R)	10	10(T) 5(R)	mg/M^3
1344-09-8	Sodium Silicate	0 - 6	15(T) 5(R)	10	NE	mg/M^3

NE = Not Established
ACGIH TLVs are 2003 values. OSHA PELs are those in effect on the date of preparation of this MSDS. The listed PELs, TVLs and RELs are time weighted average exposure limits.

Component Related Regulatory Information
This product may be regulated, have exposure limits or other information identified as the following:
Nuisance particulates.

Section 3 — Hazards Identification

Emergency Overview
APPEARANCE AND ODOR: Odorless, Yellow semi-circle or block insulation with coloring throughout as a visual marker to indicate this is an asbestos-free product.

This product is an article and under normal conditions of use, this product is not expected to create any unusual emergency hazards. However, cutting, sawing, or abrading may increase the risk of personnel exposure.

Inhalation of excessive amounts of dust created when fabricating, cutting, or other mechanical alterations of the product may cause temporary upper respiratory irritation and/or congestion— remove affected individuals to fresh air.

Skin irritation may be treated by gently washing affected area with soap and warm water.

Eye irritation may be treated by flushing eyes with large amounts of water. If irritation persists, contact a physician.

Prolonged contact with dust from this product may cause Dermatitis.
In the event of fire, use normal fire fighting procedures to prevent inhalation of smoke and gases.

HMIS Rating: Health: 1, Fire: 0, Reactivity 0, Other: 0
WHMIS Class: Thermo-12 Gold is not a WHMIS controlled product

Potential Health Effects

Summary

Breathing dust from this product may cause a scratchy throat, congestion, and slight coughing.

Getting dust or fibers on the skin, or in the eyes may cause itching, rash, or redness.

Breathing large amounts of dust or fibers from this product may lead to chronic health effects as discussed in Section 11 of this material safety data sheet.

Inhalation

Irritation of the upper respiratory tract (scratchy throat), coughing, and congestion may occur in extreme exposures.

Skin

Temporary irritation (itching) or redness may occur.

Absorption

Not applicable

Ingestion

This product is not intended to be ingested or eaten under normal conditions of use. If ingested, it may cause temporary irritation to the gastrointestinal (GI) tract, especially the stomach.

Eyes

Temporary irritation (itching) or redness may occur.

Target Organs

Upper respiratory passages, skin, and eyes.

Primary Routes of Entry (Exposure)

Inhalation (breathing dust), skin, and eye contact.

Medical Conditions Aggravated by Exposure

Pre-existing chronic respiratory, skin, or eye diseases or conditions may be aggravated by exposure to this product

Section 4 — First Aid Measures

First Aid: Inhalation

Remove to fresh air. Drink water to clear throat, and blow nose to remove dust.

First Aid: Skin

Wash gently with soap and warm water to remove dust. Wash hands before eating or using the restroom.

First Aid: Ingestion

Product is not intended to be ingested or eaten. If this product is ingested, irritation of the gastrointestinal (GI) tract may occur, and should be treated symptomatically. Rinse mouth with water to remove fibers, and drink plenty of water to help reduce the irritation. No chronic effects are expected following ingestion.

First Aid: Eyes

Do not rub or scratch your eyes. Dust particles may cause the eye to be scratched. Flush eyes with large amounts of water for 5-15 minutes. If irritation persists, contact a medical professional.

First Aid: Notes to Physician

This product is a mechanical irritant, and is not expected to produce any chronic health effects from acute exposures. Treatment should be directed toward removing the source of irritation with symptomatic treatment as necessary.

Section 5 — Fire Fighting Measures

Flash Point:	Not applicable	**Method Used:**	Not applicable
Upper Flammable Limit (UFL):	Not applicable	**Lower Flammable Limit (LFL):**	Not applicable
Auto Ignition:	Not determined	**Flammability Classification:**	Non combustible
Rate of Burning:	Not applicable		

General Fire Hazard

There is no potential for fire or explosion.

Extinguishing Media

Use any extinguishing media appropriate for the surrounding fires

Fire Fighting Equipment/Instructions

No special procedures are expected to be necessary for this product. Normal fire fighting procedures should be followed to avoid inhalation of smoke and gases produced by other materials.

Section 6 — Accidental Release Measures

Containment Procedures

Pick up large pieces. Vacuum dusts. If sweeping is necessary, use a dust suppressant such as water. Do not dry sweep dust accumulation or use compressed air for clean-up. These procedures will help to minimize potential exposures.

Clean-Up Procedures

Wastes are not hazardous as defined by the RCRA (40 CFR 261). Comply with state and local regulations for disposal of these products. If you are unsure of the regulations, contact your local Public Health Department, or the local office of the Environmental Protection Agency (EPA).

Section 7 — Handling and Storage

Handling Procedures

Use protective equipment as described in Section 8 of this material safety data sheet when handling uncontained material. Good housekeeping practices should be used to prevent generation and accumulation of dusts. After handling product, wash face and hands before eating, drinking, or smoking.

Storage Procedures

Warehouse storage should be in accordance with package directions, if any. Material should be kept dry, and protected from the elements.

Section 8 — Exposure Control and Personal Protection

General Product Information

This product may contain trace amounts of crystalline silica as a natural contaminant in the raw materials. However, standard industrial hygiene air monitoring surveys conducted under normal and test (worst-case) situations have not detected any airborne respirable crystalline silica in the occupational environment.

Personal Protective Equipment

Personal Protective Equipment: Eyes/Face

Safety glasses with side shields are recommended to keep product out of the eyes.

Personal Protective Equipment: Skin

Leather or cotton gloves should be worn to prevent skin contact and irritation. Barrier creams may also be used to reduce skin contact and irritation caused by fiber glass.

Personal Protective Equipment: Respiratory

A respirator should be used if ventilation is unavailable, or is inadequate for keeping dust and fiber levels below the applicable exposure limits. In those cases, use a NIOSH-certified disposable or reusable particulate respirator with an efficiency rating of N95 or higher (under 42 CFR 84) when working with this product. For exposures up to five times the established exposure limits use a quarter-mask respirator, rated N95 or higher; and for exposures up to ten times the established exposure limits use a half-mask respirator (e.g., MSA's DM-11, Racal's Delta N95, 3M's 8210), rated N95 or higher.

Operations such as sawing, blowing, tear out, and spraying may generate airborne fiber concentrations requiring a higher level of respiratory protection. For exposures up to 50 times the established exposure limits use a full-face respirator, rated N99 or higher.

Ventilation

In fixed manufacturing settings, local exhaust ventilation should be provided at areas of cutting to remove airborne dust and fibers. General dilution ventilation should be provided as necessary to keep airborne dust and fibers below the applicable exposure limits and guidelines. The need for ventilation systems should be evaluated by a professional industrial hygienist, while the design of specific ventilation systems should be conducted by a professional engineer.

Personal Protective Equipment: General

Loose-fitting, long-sleeved clothing should be worn to protect the skin from irritation. Exposed skin areas should be washed with soap and warm water after handling.

Section 9 — Physical & Chemical Properties

Appearance: Semi-circle or block insulation with yellow coloring throughout as a visual marker to indicate this is an asbestos free product.

Odor:	Odorless	**pH:**	Not applicable
Physical State:	Solid	**Vapor Density:**	Not applicable
Vapor Pressure:	Not applicable	**Melting Point:**	1200-1500°C
Boiling Point:	Not applicable	**Specific Gravity:**	0.24-0.27
Solubility (H2O):	Nil	**Freezing Point:**	Not applicable
Viscosity:	Not applicable	**Evaporation Rate:**	Not applicable
VOC:	Not applicable	**Percent Volatile:**	0

Section 10 — Chemical Stability & Reactivity Information

Chemical Stability

This is a stable material. This product is not reactive.

Hazardous Decomposition

None.

Hazardous Polymerization

Will not occur.

Section 11 — Toxicological Information

Acute Toxicity

A: General Product Information

The primary acute health effects of this product include mechanical irritation of the skin and eyes and skin dryness as a result of contact with dust, amorphous silica, and fibers.

B: Component Analysis - LD50/LC50

No LD50/LC50's are available for this product or its components.

Carcinogenicity

A: General Product Information

OSHA, NTP, IARC, and ACGIH have not classified this product in its entirety as a carcinogen.

B: Component Carcinogenicity

Calcium silicate (1344-95-2)

ACGIH: A4 - Not Classifiable as a Human Carcinogen

Synthetic Vitreous Fiber (65997-17-3)

ACGIH: A4 - Not Classifiable as a Human Carcinogen (related to rock wool fiber)
IARC: Monograph 43, 1988 (related to Glass filaments) (Group 3 (not classifiable))

Section 12 — Ecological Information

Ecotoxicity

A: General Product Information

No data available for this product.

B: Component Analysis - Ecotoxicity - Aquatic Toxicity

No ecotoxicity data are available for this product's components.

Section 13 — Disposal Considerations

US EPA Waste Number & Descriptions

A: General Product Information

This product, as supplied, is not regulated as a hazardous waste by the U.S. Environmental Protection Agency (EPA) under Resource Conservation and Recovery Act (RCRA) regulations. Comply with state and local regulations for disposal. If you are unsure of the regulations, contact your local Public Health Department, or the local office of the EPA.

B: Component Waste Numbers

No EPA Waste Numbers are applicable for this product's components.

Disposal Instructions

Dispose of waste material according to Local, State, Federal, and Provincial Environmental Regulations.

Section 14 — Transport Information

US DOT Information

Shipping Name: This product is not classified a hazardous material for transport.

Section 15 — Regulatory Information

US Federal Regulations

A: General Product Information

No information on this product as a whole.

B: Component Analysis

None of this product's components are listed under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65), or CERCLA (40 CFR 302.4).

State Regulations

A: General Product Information

No information available for the product.

Other Regulatory Information

A: General Product Information

No information available for the product.

B: TSCA Status

No information available for the product.

International Regulations

Canada Workplace Hazardous Materials Information System (WHMIS)

WHMIS Classification: D2B– Irritant

Product classified as a manufactured article as defined in HPA, Section 11(1). Section 12(I) exempts it from the WHMIS supplier label and MSDS requirements of the Act.

Component Analysis - WHMIS IDL

The following components are identified under the CHPA IDL:

Sodium Silicate—CAS 1344-09-8

Section 16 — Other Information

This product has been classified according to the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

Key/Legend:

EPA = Environmental Protection Agency; TSCA = Toxic Substance Control Act; ACGIH = American Conference of Governmental Industrial Hygienists; IARC = International Agency for Research on Cancer; NIOSH = National Institute for Occupational Safety and Health; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; NFPA = National Fire Protection Association; HMIS = Hazardous Material Identification System; CERCLA = Comprehensive Environmental Response, Compensation and Liability Act; SARA = Superfund Amendments and Reauthorization Act; DSL = Canadian Domestic Substance List; EINECS = European Inventory of New and Existing Chemical Substances; WHMIS = Workplace Hazardous Materials Information System; CAA = Clean Air Act; CHPA=Canadian Hazardous Product Act; IDL=Canadian Hazardous Disclosure List

Revision Summary:

This is a revised MSDS which replaces Revision 1.0.3 with new formatting and clarified exposure limits. Get this and other MSDS forms electronically via Internet: http://www.iig-llc.com or by calling 1-970-858-6200.

As of the date of preparation of this document, the foregoing information is believed to be accurate and is provided in good faith to comply with applicable federal and state law(s). However, no warranty or representation with respect to such information is intended or given.

IMPORTANT SAFETY NOTICE: The information in this MSDS relates only to the specific material described herein and does not relate to use in combination with any other material or substance or in any process.
Because of the use of this information and the conditions of use of this product are not within the control of Industrial Insulation Group, it is the users obligation to determine the conditions of safe use of this product. Users of this product should study this MSDS and become aware of the product hazards and safety information before using this product. Users should also notify their employees, agents, and contractors regarding information contained in this MSDS and any product hazards and safety information in order to provide for safe use of this product.

FOAMGLAS®

Pittsburgh Corning

Protecting Companies and Their People Worldwide

INDUSTRIAL PIPING, DUCTS AND EQUIPMENT

FOAMGLAS® insulation is a lightweight, rigid material composed of millions of completely sealed glass cells. Each cell is an insulating entity. FOAMGLAS® insulation's all-glass, closed-cell structure provides the following benefits:

- Constant Insulating Efficiency
- Zero Water Vapor Permeability
- Moisture Resistance
- Fire Protection
- Corrosion Resistance
- Long-Term Dimensional Stability
- Vermin Resistance
- CFC and HCFC Free

These benefits result in FOAMGLAS® Insulation Systems that are long-lasting, require little maintenance and are ideal for:

- Low temperature pipe, equipment, tanks and vessels
- Medium and high temperature pipes and equipment
- Hot oil and hot asphalt storage tanks
- Heat transfer fluid systems
- Hydrocarbon processing systems
- Chemical processing systems
- Above ground and underground steam and chilled water piping
- Commercial piping and ductwork

Manufactured to comply with ASTM C552-07.

FOAMGLAS® insulation is manufactured by Pittsburgh Corning in a basic block form. Blocks are fabricated into a wide range of shapes, thicknesses and sizes to satisfy industrial insulation requirements.

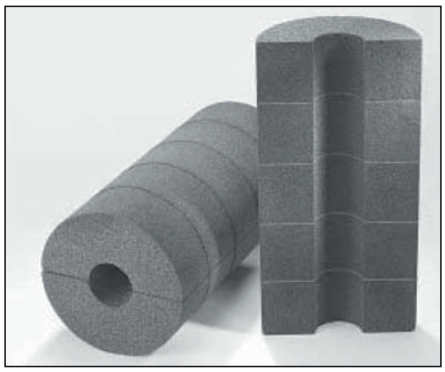
PHYSICAL AND THERMAL PROPERTIES OF FOAMGLAS® ONE™ INSULATION

PHYSICAL PROPERTIES	SI	ENGLISH	ASTM STANDARD	EUROPEAN STANDARD
Absorption of Moisture (% by Volume)	0.2%	0.2%	C 240	EN 1609
	Only moisture retained is that adhering to surface cells after immersion			
Water-Vapor Permeability	0.00 perm-cm	0.00 perm-cm	E96 Wet Cup, Procedure B	EN ISO 10456
Acid Resistance	Impervious to common acids and their fumes except hydrofluoric acid			
Capillarity	None	None		EN 1609
Combustibility	Noncombustible, will not burn.		E 136	EN ISO 1182 (Class A1)
Composition	Soda-lime silicate glass — inorganic with no fibers or binders.			
Compressive Strength Average for Standard Material (+/-10%)	600 kPA	90 psi	C 165 C 240 C 552	EN 826
	Strength for flat surfaces capped with hot asphalt. For curved surfaces and pipe supports, contact PCC.			
Density, Average	120 kg/m^3	7.5 lb/ft^3	C 303	
Dimensional Stability	Excellent — does not shrink, swell or warp.			EN 1604
Flexural Strength, Block Average	480 kPa	70 psi	C 203 C 240	
Hygroscopicity	No increase in weight at 90% relative humidity.			EN 12089
Linear Coefficient of Thermal Expansion 25°C to 300°C (75°F to 575°F)	9.0 x 10^{-6}/°K	5.0 x 10^{-6}/°F	E 228	EN 13571
Maximum Service Temperature	480°C	+900°F		EN 14706
Modulus of Elasticity, Approx.	900 MPa	1.3 x 10^5 psi	C 623	
Thermal Conductivity	W/mK 0.039 @ 0°C 0.040 @ 10°C	Btu-in/hr•ft^2•°F 0.29 @ 75 °F 0.28 @ 50 °F	C 177 C 518	EN 12667 EN 12939
Specific Heat	0.84 kJ/kg•°K	0.20 Btu/lb•°F		
Thermal Diffusivity	4.2 x 10-7m^2/sec	0.016 ft^2/hr		

Notes: Measurements were collected using ASTM guidelines and, unless otherwise specified, properties were collected at 24°C (75°F). Properties may vary with temperature. The measurements listed in the table are average or typical values recommended for design purposes, and are not intended as specification or limit values.

FOAMGLAS® ONE™ INSULATION SYSTEMS FOR INDUSTRIAL APPLICATIONS

Pittsburgh Corning has developed insulation systems for a wide range of piping and equipment applications—above ground or underground, indoors or outdoors—at operating temperatures from -450°F to +900°F (-268°C to +482°C).



With the patented StrataFab® System, blocks of FOAMGLAS® insulation are laminated into billets using a special high temperature adhesive. These billets are fabricated into the desired shapes and sizes for pipe, tank, vessels, flanges and valves—practically any industrial insulation application.

Totally Impermeable

Long Term Performance
Because it consists of closed glass cells, FOAMGLAS® insulation resists moisture in both liquid and vapor forms. When tested in accordance with ASTM E96, it has a permeability rating of 0.00 perm-in.

Noncombustible
FOAMGLAS® insulation is 100% glass and contains no binders or fillers—it cannot burn. FOAMGLAS® insulation will not absorb flammable liquids or vapors. If a fire does occur, FOAMGLAS® insulation will help contain it.

Corrosion-Resistant
All-glass FOAMGLAS® insulation is unaffected by common chemicals and by most corrosive plant atmospheres. It does not promote metal corrosion and its moisture resistance will help keep water from reaching equipment and piping.

Dimensionally Stable
FOAMGLAS® insulation is unaffected by temperature differentials and humidity. It will not swell, warp, shrink or otherwise distort. The insulation system's integrity remains intact.

High Compressive Strength
FOAMGLAS® insulation can withstand loads which crush most other insulating materials. In a properly designed piping system, FOAMGLAS® insulation eliminates the need for special treatment at pipe cradles. It also provides a firm base for roof membranes, jacketing or vapor retarders, prolonging their life.

Technical Service
Pittsburgh Corning's Technical Service Staff provides product, application and materials testing—standardized and customized specifications—on-site customer assistance and installation guidance.

For complete data on FOAMGLAS® Insulation Systems, please visit our Web site at www.foamglas.com, or contact Pittsburgh Corning at any of the following locations:

Pittsburgh Corning USA
(Corporate Headquarters)
800 Presque Isle Drive
Pittsburgh, PA 15239
Tel: 1-724-327-6100
Fax: 1-724-387-3807

Pittsburgh Corning Corporation Asia
(Asia Headquarters)
Pittsburgh Corning Corporation
3-7-4-304 Hikarigaoka
Nerima-ku, Tokyo, Japan 179-0072
Tel & Fax: 011 81-3-5997-0248

Pittsburgh Corning Europe NV
(Europe / Middle East Africa
Headquarters)
Albertkade, 1
B-3980 Tessenderlo
Belgium
Tel: +32-13-66-17-21
Fax: +32-13-66-78-54

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www.GreenSpec.com

ISO 9001:2000
KEMA CERTIFICATE
Accredited by ANSI-RAB NAP
Accredited by the Dutch Council for Accreditation (RvA)

BCCA ISO 9001:2000

STANDARDS, CERTIFICATIONS* AND APPROVALS

FOAMGLAS® insulation can be certified to conform to the requirements of:

- ASTM C 552 "Specification for Cellular Glass Thermal Insulation"
- Military Specification MIL-I-24244C, "Insulation Materials, Thermal, with Special Corrosion and Chloride Requirement"
- Nuclear Regulatory Guide 1.36, ASTM C 795, C 692, C 871
- Flame Spread 5, Smoke Developed 0 (UL 723, ASTM E 84), R2844; also classified by UL of Canada, CR1957
- ISO 9001:2000
- UL 1709
- For a listing of UL Through Penetration Fire Stop Approved Systems please search the UL Database at http://www.ul.com/ Once on this page click on CERTIFICATIONS on the left hand side. Under General Search click on UL FILE NUMBER and type in R15207 and then SEARCH
- Board of Steamship Inspection (Canada) Certificate of Approval No. 100/F1-98
- General Services Administration,PBS (PCD): 15250, Public Building Service Guide Specification, "Thermal Insulation (Mechanical)"
- New York City Dept. of Bldgs., MEA #138-81-M FOAMGLAS® insulation for piping, equipment, walls and ceilings
- New York State Uniform Fire Prevention and Building Code Dept. of State (DOS) 07200-890201-2013
- City of Los Angeles General Approval RR22534

FOAMGLAS insulation is identified by Federal Supply Code for Manufacturers (FSCM 08869)

***Written request for certificate of compliance must accompany order.**

FOAMGLAS®

Printed in U.S.A.

FG-3 Rev. 1/09 (Replaces Rev. 11/05)

Material Safety Data Sheet

SECTION 1 – CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product Name: FOAMGLAS® insulation, FOAMGLAS® One™ insulation, FOAMGLAS® HLB insulation

Manufacturer/Supplier:
Pittsburgh Corning Corporation
800 Presque Isle Drive
Pittsburgh, PA 15239

Information Number: 724-327-6100
CHEMTREC: 800/424-9300

Generic Name: cellular glass insulation

Use: Insulation of tanks, spheres, piping, roofs and equipment

General Comments: General information and emergency information available 8:00 AM – 5:00 PM Monday through Friday.

CHEMTREC telephone number is to be used only in the event of chemical transportation emergencies involving a spill, leak, fire, exposure, or accident involving chemicals. All non-emergency questions should be directed to technical service.

SECTION 2 - COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient	App. % by Vol.	CAS #
Hydrogen Sulfide	< 1.2	7783-06-4
Carbon Monoxide	0 - 4	630-08-0
Carbon Dioxide	85 - 95	124-38-9
Glass Dust	Varies	NA

SECTION 3 – HAZARDOUS IDENTIFICATION

HYDROGEN SULFIDE
(EFFECTS OF OVEREXPOSURE TO HYDROGEN SULFIDE GAS WHEN CELLS ARE BROKEN WITHOUT ADEQUATE VENTILATION)

ROUTES OF EXPOSURE: Inhalation, Eyes.

IMMEDIATE EFFECTS:

Inhalation - headache, nausea, and difficult breathing, dizziness . The sense of smell may be fatigued over time. The odor and irritating effects do not offer dependable warning to workers who maybe exposed to gradually increasing amounts and therefore become used to it.

Eyes - irritation and inflammation of the mucous membrane, tearing, sensitivity to light

CHRONIC:

Inhalation – Chronic poisoning results in headache, inflammation of the eyelids and the mucous membrane that lines the inner surface of the eyelids, digestive disturbances, weight loss and general weakness.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE TO HYDROGEN SULFIDE: Pre existing upper respiratory and lung diseases such as, but not limited to bronchitis, emphysema and asthma, pulmonary heart disease or eye problems.

GLASS PARTICLES

EFFECTS OF EXPOSURE TO GLASS PARTICLES

ROUTES OF EXPOSURE: Inhalation, Eyes, Skin, Ingestion.

IMMEDIATE EFFECTS:

Inhalation - dryness and irritation of the mucous membranes and respiratory tract.

Eyes - irritation and inflammation of the mucous membrane, tearing, sensitivity to light

Skin - irritation or abrasion from glass particles.

Ingestion - possible abrasion of mouth and throat from glass particles.

CHRONIC:

Inhalation – Prolonged or repeated overexposure to airborne glass dust can lead to inflammation and scarring of lung tissue.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE TO GLASS PARTICLES: None known

SECTION 4 – FIRST AID MEASURES

GENERAL ADVICE:

INHALATION: Move the exposed person to fresh air at once, apply artificial respiration if needed. Call poison center, physician or emergency medical service giving CAS names and numbers of gases. Encourage victim to cough, spit out, and blow nose to remove dust. If breathing is difficult, GET MEDICAL ATTENTION.

SKIN CONTACT: Wash thoroughly without pressure. If irritation persists or skin is broken, consult physician.

EYE CONTACT: Flush with potable water for 15 minutes, do not rub or apply pressure. Consult physician or emergency medical service

INGESTION: Do not induce vomiting. Consult physician, emergency medical service or poison center.

SECTION 5 – FIRE FIGHTING MEASURES

SUITABLE EXTINGUISHING MEDIA: water, dry chemical or carbon dioxide

EXPLOSION DATA:

SENSITIVITY TO MECHANICAL IMPACT: NA
SENSITIVITY TO STATIC DISCHARGE: NA

SPECIAL FIRE FIGHTING PROCEDURES: May release hydrogen sulfide and carbon monoxide gas when involved in a fire. The small amounts of hydrogen sulfide and carbon monoxide released are not expected to contribute to the intensity of a fire. Wear self contained breathing apparatus and protective clothing.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

PRECAUTIONS FOR PERSONNEL: Wear proper protective clothing and equipment.

ENVIRONMENTAL PRECAUTIONS: Ensure adequate ventilation. Use dustless methods. All in accordance with local, state and federal government regulations.

PROCESS FOR CLEANING: Collect in sift proof containers. Avoid generation of dust.

SECTION 7 – HANDLING AND STORAGE

EXPOSURE GUIDELINES: Engineering Controls: When cutting, grinding, crushing, or drilling FOAMGLAS® insulation, provide general or local ventilation systems, as needed, to maintain airborne dust concentrations below the regulatory limits. Local vacuum collection is preferred since it prevents release of contaminants into the work area by controlling it at the source. Other technologies that may aid in controlling airborne respirable dust include wet suppression, ventilation, process enclosure, and enclosed employee work stations. When exposed to dust above recommended limits, wear a suitable NIOSH-approved respirator with a protection factor appropriate for the level of exposure. Seek guidance from a qualified industrial hygienist or safety professional, prior to respirator selection and use.

HANDLING: Avoid generation of dust. Wash hands before eating, drinking, smoking or using toilet..

STORAGE: If storing for long periods, protect product from weather

KEEP AWAY FROM CHILDREN

RESPIRATORY PROTECTION: Use nuisance dust mask when cutting or abrading with adequate ventilation. Seek guidance from a qualified industrial hygienist or safety professional, prior to dust mask/respirator selection and use. (Supplied air or self-contained breathing apparatus in poorly ventilated areas is required when cutting or crushing of FOAMGLAS® insulation causes PEL of hydrogen sulfide and carbon monoxide gases to be exceeded.

VENTILATION: Use local exhaust when cutting. Use mechanical ventilation when crushing large volumes.

PROTECTIVE GLOVES: Gloves - rubber impregnated canvas - for abrasion protection..

EYE PROTECTION: When cutting, grinding, crushing, or drilling FOAMGLAS® insulation, wear safety glasses with side shields or dust goggles

in dusty environments. Goggles for dust protection while cutting or abrading in wind or overhead work.

OTHER PROTECTIVE MEASURES: Normal work clothes including long sleeved shirt is recommended.

SPECIAL PRECAUTIONS: Respirable dust particles may be generated by crushing, cutting, grinding or drilling FOAMGLAS® insulation. Follow protective controls listed in the Exposure Guidelines above when handling these products.

SECTION 8 – EXPOSURE RESTRICTIONS AND PERSONAL PROTECTION

		EXPOSURE LIMITS			
Ingredient	**App. % by Vol.**	**TLV***	**NIOSH REL TWA**	**PEL****	**CAS #**
Hydrogen Sulfide	< 1.2	10 ppm	UN	10 ppm TWA	7783-06-4
Carbon Monoxide	0 - 4	25 ppm	UN	50 ppm TWA	630-08-0
Carbon Dioxide	85 - 95	5000 ppm	UN	5000 ppm TWA	124-38-9
Glass Dust	Varies	10 mg/m^3	UN	15 mg/m^3 5 mg/m^{3a} ([a]respirable)	NA

ADDITIONAL ADVICE: PEL for hydrogen sulfide may be reached if 1 cubic ft of material is crushed in a closed space of 3000 cubic ft. See Section 7.

* American Conference of Governmental Industrial Hygienists.
** OSHA 29 CFR 1917.24

SECTION 9 – PHYSICAL PROPERTIES

Freezing Point: °C (°F)	NA	Flash Point : °C (ºF) TCC	NA
Boiling Point: °C (ºF)	NA	Ignition Temperature: °C (ºF)	NA
Vapor Pressure (MM Hg):	NA	Flammable Limits: LEL UEL	NA NA
Melting Point: : °C (ºF)	732 (1350)	Specific Gravity (H_20 = 1):	0.11 – 0.22
Vapor Density (Air = 1)	NA	Percent Volatile By Volume (%)	NA
Solubility in Water:	Insoluble	pH:	NA
Appearance and Odor:	Black cellular material, no odor unless cut or crushed	Evaporation Rate (BuAC=1)	NA
Odor Threshold:	0.002 ppm	Coefficient of Water/Oil Distribution:	NA

SECTION 10 – STABILITY AND REACTIVITY

STABILITY: Stable

CONDITIONS TO AVOID: NA

MATERIALS TO AVOID: NA

HAZARDOUS POLYMERIZATION: Will Not Occur.

HAZARDOUS DECOMPOSITION PRODUCTS: None

SECTION 11 – TOXICOLOGICAL INFORMATION

CAS #	INGREDIENT	DERMAL LD50	INHALATON LD50	ORAL LD50
7783-06-4	Hydrogen Sulfide	NE	444 ppm-rat 634 ppm-mus	NE
630-08-0	Carbon Monoxide	NE	1807 ppm-rat 2444 ppm-mus	NE
124-38-9	Carbon Dioxide	NE	NE	NE
NA	Glass Dust	NE	NE	NE

CAS #	INGREDIENT	CARCINOGENICITY ACGIH	CARCINOGENICITY IARC	TERATOGENICITY	MUTAGENICITY
7783-06-4	Hydrogen Sulfide	NE	NE	NE	NE
630-08-0	Carbon Monoxide	NE	NE	NE	NE
124-38-9	Carbon Dioxide	NE	NE	NE	NE
NA	Glass Dust	NE	NE	NE	NE

Note:

SECTION 12 – ECOLOGICAL INFORMATION

VOLATILE ORGANIC COMPOUNDS: 0 Grams Per Liter (g/l). 0 Pounds Per Gallon (lb/g).

SECTION 13 – DISPOSAL CONSIDERATIONS

DISPOSAL METHOD: Disposal should be made in accordance with Federal, State and Local regulations.

SECTION 14 – TRANSPORT INFORMATION

SHIPPING CLASS: Not Regulated

SECTION 15 – REGULATORY INFORMATION

SARA SECTION 302:
SARA (311,312) HAZARD CLASS:
SARA (313) CHEMICALS: NONE
CERCLA: NA
CPSC CLASSIFICATION:

HMIS:	FLAMMABILITY:	0	REACTIVITY:	0	HEALTH:	0
NFPA:	FLAMMABILITY:	0	REACTIVITY:	0	HEALTH:	0

WHMIS CLASSIFICATION: D 2B

CALIFORNIA PROPOSITION 65:

☐ A. This product contains a chemical known to the State of CA to cause birth defects or other reproductive harm.
☐ B. This product contains a chemical known to the State of CA to cause cancer.
☐ C. This product contains a chemical known to the State of CA to cause cancer and birth defects or other reproductive harm.

SECTION 16 – OTHER INFORMATION

NA = not applicable NE = not established UN = unavailable CL = Ceiling Limit
NEGL = Negligible PROP. = Proprietary

VW Temperature Sensor

Applications

The VW temperature sensor is used to monitor the heat of hydration in mass concrete.

Operation

The VW temperature sensor consists of a stainless steel body, a wire held in tension within the body, an electromagnetic coil, and signal cable.

The body of the sensor expands and contracts with changes in temperature, increasing or decreasing the tension of the wire inside the body.

When a readout is connected to the sensor, it sends an electric pulse to coil, which plucks the wire and causes it to vibrate at its natural frequency. A second coil picks up the vibration and returns a frequency to the readout.

The frequency reading is converted to units of temperature by applying calibration factors.

Advantages

High Accuracy: The VW temperature sensor has a standard accuracy better than ± 0.5 °C and can be ordered with accuracy better than ± 0.3 °C.

VW Compatible: The temperature sensor is read by the same devices that monitor other VW sensors at the site.

Manual or Automatic Readings: The sensor can be read manually using the VW Data Recorder or automatically using a data logger.

Reliable Signal Transmission: The strong VW signal can be transmitted reliably over long distances with properly shield cable.

VW TEMPERATURE SENSOR

VW Temperature Sensor 52631510

Sensor Type: Pluck type vibrating wire sensor with built-in thermistor or RTD and transient protection device.

Range: -20 to 80°C (100° Span). Other ranges available on special order.

Resolution: 0.025% FS.

Calibration Accuracy: ±0.5% FS or on special order, ±0.3% FS.

Response Time: 2.5 minutes for 60% of full thermal equilibrium.

Full Thermal Equilibrium: 15 minutes.

Dimensions: 19 x 115 mm (0.75 x 4.5").

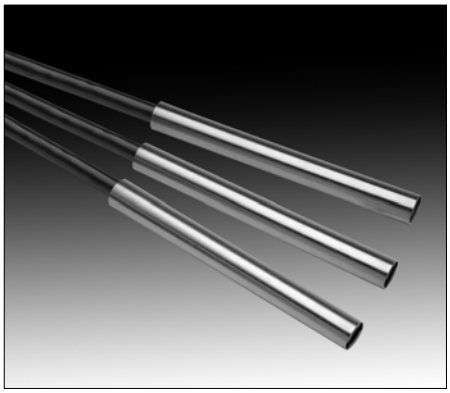
Materials: Brass body.

Weight: 145 g (0.32 lb.).

SIGNAL CABLE FOR VW SENSOR

Signal Cable 50613524

Shielded cable with four copper conductors and cable jacket rated to 80°C. Specify cable length required for each sensor.



RTD AND THERMISTOR SENSORS

RTD Temperature Sensor 92600056
Thermistor Temperature Sensor . 92600057

These economical temperature sensors employ resistance temperature devices rather than vibrating wire transducers. When read by standard VW readouts, they return a reading in degrees C. Otherwise, they return a voltage reading that can be converted to units of temperature by applying calibration factors.

Sensor Type: RTD (2K ohm) or Thermistor (3 k ohm).

Range: -20 to 80°C. Other ranges available.

Resolution: 0.2°C with VW Data Recorder.

Accuracy: ±0.5°C.

Dimensions: 9.5 x 101 mm (0.375 x 4").

Materials: Brass body.

Weight: 50g (0.11 lb.).

Signal Cable: Same as VW temperature sensor.

Readout and Data Loggers: VW Data Recorder and most types of data loggers.

SIGNAL CABLE

High-Temperature Signal Cable. . 52602320

For use with RTDs or thermistors. Shielded cable with two copper conductors and thermal rubber jacket rated to 115°C.

READOUTS

VW Data Recorder 52613500
Jumper to Terminal Box 52613557

VW Data Recorder reads VW sensors and returns a reading in volts. It also reads RTDs and Thermistors and returns a reading in degrees C. See separate data sheet.

TERMINAL BOXES

Terminal Box for 6 sensors 57711606
Terminal Box for 12 Sensors 57711600
Terminal Box for 24 Sensors 97711624

Provides terminals for signal cable from 6, 12, or 24 sensors. Sensors are selected by rotary switch. Small 6-sensor box is 240 x 190 x 120 mm (9.5 x 7.5 x 4.75"). Larger 12 and 24-sensor box measures 290 x 345 x 135 mm (11.5 x 13.5 x 5.25").

DATA LOGGERS

VW Temperature Sensors: Campbell Scientific CR1000 with AVW200 has capacity for 2 VW sensors. With an AM16/32 multiplexer connected, capacity increases to 16 or 32.

Campbell Scientific CR1000 has capacity for 8 RTDs or Thermistors. With an AM16/32, capacity increases to 32 RTDs or Thermistors.

Durham Geo Slope Indicator, 12123 Harbour Reach Drive, Mukilteo, WA, 98275 USA
Tel: 425-493-6200 Tel: 866-916-0541 Fax: 425-493-6250 Email: solutions@slope.com

DGSI
DURHAM GEO SLOPE INDICATOR

CAMERON

DISTRIBUTED VALVES

Valves and Products For Oilfield Applications

DEMCO® NAVCO® NUTRON® TEXSTEAM™
THORNHILL CRAVER® UNIBOLT™ WHEATLEY® WKM®

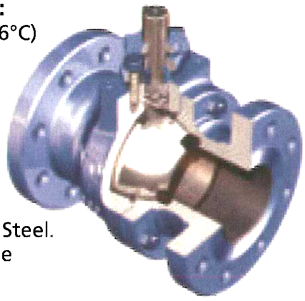
WKM® DynaSeal® 310 FLANGED BALL VALVES

WKM DynaSeal 310 Ball Valves are premium quality floating ball valves proven in a myriad of applications.

Sizes:
Full Port: 1/2 in. through 12 in. (15 mm through 300 mm)
Reduced Port: 3/4 in. through 14 in. (20 mm through 350 mm)

Pressure Classes:
150, 300 through 12 in. (300 mm), 600 through 6 in. (150 mm)

Operating Temperatures:
-50°F to 600°F (-46°C to 316°C)



End Connections:
Flanged,
(Weld Ends ASME 300)

Body Styles:
2-Piece

Body Materials:
Carbon Steel and Stainless Steel.
A Variety of Trims Available

Features

- Deep Protective Seat Pockets
- Fire Tested
- Positively Retained Stem with Adjustable Packing for Low Emission
- Extended Service

Options:
Pneumatic, Electrical and Hydraulic Actuators, Solenoid Valves, Limit Switches

Fugitive Emissions:
DynaSeal 310 Ball Valves can be supplied and certified to meet the requirements of fugitive emissions as regulated by the 1990 Amendment to The Clean Air Act.

WKM® DynaSeal® 310 FLOATING BALL VALVES THREADED ENDS

A premium quality floating ball valve proven in multiple and diverse applications. Deep pocket protects seats. Fire Tested design and full port available in a range of sizes. Positively retained stem with adjustable packing for low emission, extended service. Easily automated and available in a wide variety of materials to cover a broad range of applications.

Sizes:
Full Port: 1/4 in. through 3 in. (8 mm through 80 mm)
Reduced Port: 1/2 in. through 4 in. (15 mm through 100 mm)

Pressure Ratings:
To 5000 psi in small sizes

Operating Temperatures:
-50°F to 600°F
(-46°C to 316°C)

End Connections:
Threaded Ends

Materials:
Carbon Steel, Stainless Steel
Wide range of Trim Materials

Features

- Deep Protective Seat Pockets
- Fire Tested
- Positively Retained Stem with Adjustable Packing
- Extended Service

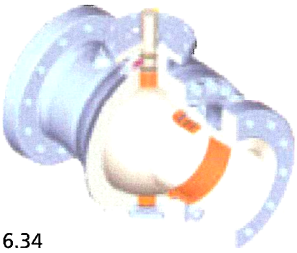
WKM® DynaSeal® 370D4 BALL VALVES

WKM® DynaSeal® 370D4 Ball Valves satisfy a wide range of ASME and API 6D applications.

Sizes:
2 in. - 14 x 12 in. (50 mm - 350 x 300 mm) ASME 150 - 900
14 in. & 16 in. (350 mm & 400 mm) ASME 150 - 600
2 in. - 6 x 4 in. (50 mm - 150 x 100 mm) ASME 1500/2500
2 in. - 4 in. (50 mm - 100 mm) API 5000

Operating Temperatures:
-50°F to 400°F
(-46°C to 204°C)

Features



- Double-Block-and-Bleed with Bleed Fittings
- Automatic Body Pressure Relief
- Fire Tested API 6FA
- Field Repairable
- Bi-directional Flow
- Positively Retained Stem
- Statically Grounded Ball
- Position Indicators
- Stem Sealant Injection
- Design Standard ASME B16.34
- Seat Sealant Injection with Secondary Check Valves under Fitting
- Buried NACE Trim

Options

- RPTFE Face Seals
- Stainless Steel Trims
- Stainless Steel Valves

WKM® B20 BALL VALVE

A quality, economical Ductile Iron ball valve used for threaded end oilfield applications utilizing a two-piece bolted-together body and tailpiece design.

Size:
Full Port: 2 in. (50 mm)
Reduced Port: 2 in. (50 mm)

Working Pressure:
2000 psi

Operating Temperatures:
-20°F to 250°F
(-29°C to 120°C)

Materials:
Ductile Iron with
Carbon Steel or
Stainless Steel Internals

Features

- 2-Piece Bolted Threaded End
- Conforms to NACE MR0175 (2002) Specifications
- Positively Retained Stem Design

WKM® DynaSeal® 210A FLOATING BALL VALVE

This rugged, but economical ductile iron ball valve is the valve of choice for threaded end oilfield applications where carbon steel body material is not a requirement. 2-Piece design with ductile iron body and tailpiece.

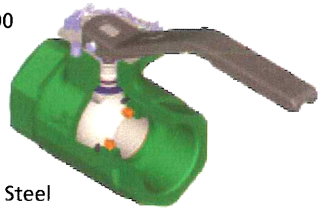
Sizes:
1 in. to 4 x 3 in.
(25 mm to 100 x 80 mm)

Pressure Classes:
ASME 1000, 1500, 2000

End Connections:
API Line Pipe Threads

Body Materials:
Ductil Iron

Stem/Ball:
Carbon Steel/Stainless Steel



Seat/Seals:
Delrin/Buna-N

Features

- Locking Capability is Standard
- Positively Retained Stem
- Superior Stem Journal Design Prevents Stem Seizure
- Deep Pocketed Seats
- TEFLON Body Seal
- Fire Tested Seat Design

NAVCO® S20 FLOATING BALL VALVES

The NAVCO S20 Ball Valve provides a versatile, quality ball valve at an economical price.

Sizes:
1/4 in. FP (8 mm) - 2 in. FP (50 mm).

Working Pressure:
2000 psi

Operating Temperatures:
-20°F to 500°F
(-29°C to 260°C)

End Connections:
API Line Pipe Threads

Body Styles:
2-Piece

Body Materials:
Investment Cast

Features

- Conforms to NACE MR0175 (2002)
- Positive Retained Stem
- Locking Handle Device
- Fire Tested & Certified API 607 5th Edition

NUTRON® MODEL T3 FLOATING BALL VALVES

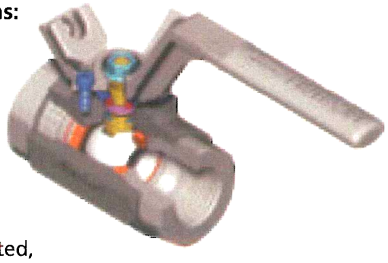
NUTRON Floating Ball Valves provide a range of quality, floating ball valves at an economical price.

Sizes:
1/4 in. - 4 in.
(8 mm - 100 mm)

Pressure Classes:
ASME 150 - 2500
Working Pressure to 6000 psi

Operating Temperatures:
-150°F to 500°F
(-100°C to 260°C)

End Connections:
Threaded,
Flanged,
Socket Weld,
Butt Weld



Body Style:
3-Piece

Body Materials:
Carbon Steel,
Carbon Steel Plated,
Stainless Steel and Special Alloys

Features

- Adjustable Packing
- Fire Tested API 598 and API 607 4th Edition
- Conforms to NACE MR0175 (2002)/ISO 15156
- Positively Retained Stem Design
- Handle Locking Device

NUTRON® MODEL B3 FLOATING BALL VALVES

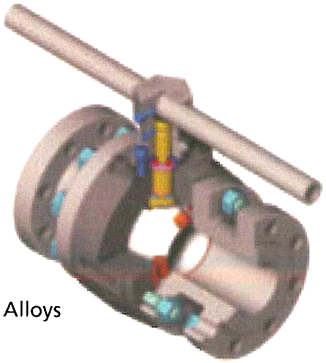
NUTRON Floating Ball Valves provide a range of quality, floating ball valves at an economical price.

Sizes:
1 1/2 in. - 6 in.
(40 mm - 150 mm)

Pressure Classes:
ASME 150 - 1500
Working Pressure to 4000 psi

Operating Temperatures:
-150°F to 500°F
(-100°C to 260°C)

End Connections:
Threaded,
Flanged,
Socket Weld,
Butt Weld



Body Style:
3-Piece

Body Materials:
Carbon Steel,
Carbon Steel Plated,
Stainless Steel and Special Alloys

Features

- Adjustable Packing
- Fire Tested API 598 and API 607 4th Edition
- Conforms to NACE MR0175 (2002)/ISO 15156
- Positively Retained Stem Design
- Handle Locking Device

DEMCO® BUTTERFLY VALVES

DEMCO Butterfly Valves are resilient seated valves designed for dependable service in a wide variety of applications. The DEMCO Butterfly Valve is available in three series:

Extended Neck (NE-C and NF-C),

Short Neck (NE-I) and

Notched (NE-D).

The Short Neck NE-I series is also available with a trim for sanitary service.

The NEI-T Features a Teflon-Lined Seat.

DEMCO Butterfly Valves are also suited for Marine Application with ABS Type Approval and USCG Category A Acceptance.

Sizes:
NE-C, NF-C: 2 in. - 36 in.
(50 mm - 900 mm)

Sanitary NE-I: 2 in. - 12 in.
(50 mm - 300 mm)

NE-D: 2 in. - 12 in.
(50 mm - 300 mm)

NEI-T: 2 in. - 10 in.
(50 mm - 250 mm)

Working Pressure:
2 in. - 12 in.
(50 mm - 300 mm):
to 285 psi

2 in. - 10 in.
(50 mm - 250 mm)
NEI-T to 150 psi

14 in. - 36 in.
(350 mm - 900 mm):
to 150 psi

Lug Body

End of Line Service:
200 psi, 2 in. - 12 in.
(50 mm - 300 mm)

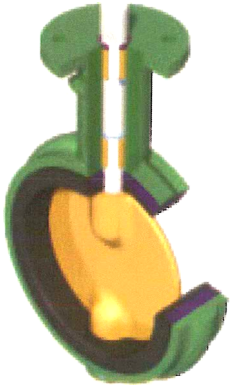
150 psi, 14 in. - 36 in.
(350 mm - 900 mm)

Operating Temperatures:
-30°F to 300°F
(-34°C to 149°C)

Body Styles:
Flangeless Wafer,
Threaded Lug

Body Materials:
Cast Iron, Ductile Iron,
Carbon Steel,
Stainless Steel,
Aluminum Bronze,
Aluminum

Trims:
A Variety of Alloys and
Elastomers are Available



Wafer Body

Features

- Blowout-Proof Stem
- Bronze Bearings
- Dry Stem Journals
- High Flow Disc
- Hard Backed Cartridge Seat
- Universal Top Flange for Ease of Automation

NAVCO® SERIES E RESILIENT SEAT BUTTERFLY VALVE

The NAVCO Series E Butterfly Valve is available in wafer or lug body style.

Sizes/Pressure Classes:
200 psi 2 in. - 12 in. (50 mm - 300 mm)

150 psi 14 in. - 24 in. (350 mm - 600 mm)

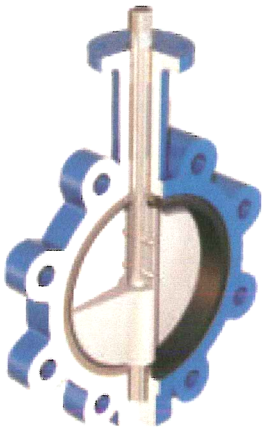
Operating Temperatures:
-30°F to 275°F (-34°C to 135°C)

Body Styles:
Wafer, Lug

Body Materials:
Cast Iron
Wafer Only 14 in. - 24 in.
(350 mm - 600 mm)

Ductile Iron
Lug 2 in. - 24 in.
(50 mm - 600 mm)

Wafer
2 in. - 12 in.
(50 mm - 300 mm)



Features

- 1-Piece through Stem
- Large Top Flange
- Integral Flange Seals No Gaskets Required
- Streamlined Disc Design
- Hard, Phenolic Backed Cartridge Seat
- Compatible with ASME Class 125/150 Flanges

WKM DynaCentric® BUTTERFLY VALVES

WKM DynaCentric Butterfly Valves are High Performance Butterfly Valves engineered for heavy-duty, maintenance free performance in a variety of applications.

Sizes and Pressure Classes:
2 1/2 in. - 36 in. (65 mm - 900 mm). ASME 15(

2 1/2 in. - 24 in. (65 mm - 600 mm). ASME 30(

3 in. - 12 in. (80 mm - 300 mm). ASME 600

Operating Temperatures:
-50°F to 1000°F (-46°C to 538°C)

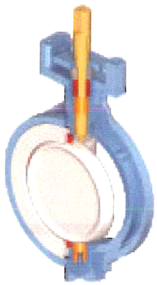
Body Styles:
Flangeless Wafer,
Threaded Lug

Body Materials:
Carbon Steel, Stainless Steel
A Variety of Trims are Available

Lug Body

Features

- Positively Retained Stem
- Heavy-Duty Eccentric Disc
- Available Fire Tested
- Bi-directional
- Choice of Three Seat Types
- Fire Safe Seat has Two Independent 316 Seat Rings surrounding RTFE Insert for Three Full Time, Bi-directional Seals instead of One
- Available CE PED (Pressure Equivalent Directive) 97/23/EC



Wafer Body

DEMCO® DM GATE VALVE

The premium design in the oil and gas drilling market, DEMCO Series DM Gate Valves are specifically engineered for the rigorous requirements of oilfield applications.

Sizes:
1 1/2 in. - 8 x 6 in.
(40 mm - 200 x 150 mm)

Pressure Classes:
1000, 2000, 3000, 5000 psi WP
ASME 400-1500

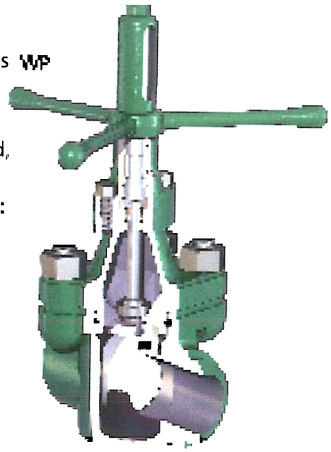
End Connections:
Threaded, Weld, Flanged, Grooved

Body/Bonnet Materials:
Steel

Stem, Gate and Seat Inserts:
Steel and Stainless Steel

Seats:
Buna-N, Viton

Optional Materials:
Seat: Hypalon, Viton



Features

- In-Line Field Repairability
- Double Acting Thread Design for Fast Operation
- Exclusive Seat Design for Drop-Tight Sealing

DEMCO® DM 7500 GATE VALVE

Meeting the tough 7500 psi working pressure demands of deep well drilling is the DEMCO DM 7500 Gate Valve.

Sizes:
2 in. to 6 x 5 in. (50 mm to 150 x 125 mm)

Pressure Ratings:
7500 psi WP, 11,250 Test

End Connections:
Butt Weld, Flanged, Grayloc

Materials:

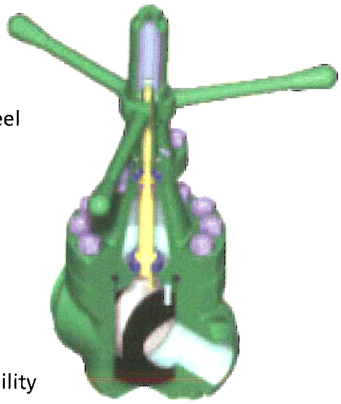
Body/Bonnet:
Alloy Steel

Gate:
Alloy Steel, Stainless Steel

Stems:
410 SS, 17-4 SS

Seat/Seal:
HNBR, Viton

Body Wear Rings/ Seat Ring:
Carbon Steel, 410 SS



Features

- In-Line Field Repairability
- Unique, Abrasion Resistant, 1-Piece Seat Design
- Locking Seat Alignment
- Body Wear Rings
- Rising Stem Design
- Replaceable Stem Packing
- Flow Cleansed Design

DEMCO® SERIES DT GATE VALVES

Known throughout the industry for their quality design and rugged dependability, DEMCO Corrosion-Resistant Gate Valves and Accessories are made especially for waterflood and Co_2 applications.

Sizes:

Series DT:
2 in. to 6 in. (50 mm to 150 mm)

Series DB:
6 x 4 in., 6 in. and 8 x 6 in.
(150 x 100 mm, 150 mm and 200 x 150 mm)

Pressure Classes:
2 in. to 4 in. (50 mm to 100 mm)
DT: ASME 600, 900, 1500

6 in. (150 mm)
DT: ASME 900

6 in. (150 mm)
DB: ASME 600, 900, 1500

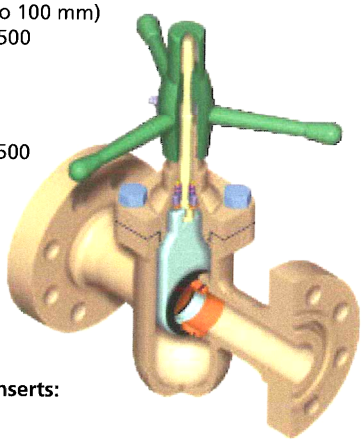
8 in. (200 mm)
DB: ASME 600, 900

End Connections:
Threaded, Flanged

Standard Materials:

Body/Bonnet:
Aluminum Bronze

Stem, Gate and Seat Inserts:
Stainless Steel



Optional Materials:

DT: Body/Bonnet:
Stainless Steel

Seats:
HNBR, Viton or P-10

DB: Seat Elastomer:
Viton, 90 Duro PC/Buna

Features

- In-Line Repairability
- Corrosion Resistant Materials are Standard
- Stem Back-Seat Capability
- Rising Stem Design

ACCESSORIES

Ball check valves, flow tees, strainers and chokes are available to complete requirements for an entire injection assembly.

- Ball Check Valves
- Flow Tees
- Strainers

Ball Check Valve

Flow Tee

Strainers

WHEATLEY® SERIES 820 CHECK VALVES

The 820 is packed with features you normally have to ask for and pay extra for.

Sizes:
1/2 in. - 4 in.
(15 mm - 100 mm)

Pressure Ratings:
275 psi - 3600 psi

Operating Temperatures:
-20°F to 400°F
(-29°C to 204°C)

End Connections:
NPT Threaded,
Grooved End

Materials:
Carbon Steel,
Stainless Steel,
Ductile Iron,
Aluminum Bronze

Features

- Full Opening
- 316 Stainless Steel Trim
- Beveled Self Aligning Seat Design
- Peroxide Cured Buna Primary Seat Seals
  Metal-to-Metal Secondary Seal
- FKM seals (Optional)
- NACE MR0175 (2002)
- Horizontal or Vertical Flow-Up Service
- Below-the-Threads Cover Seal isolates the Cover Threads from Line Media

TEXSTEAM™ C-3A SERIES CHECK VALVE

For years TEXSTEAM has been the check valve the oil patch has relied on for quality, dependability and years of trouble-free service.

Sizes:
1 in. - 4 in.
(25 mm - 100 mm)

Pressure Ratings:
300 psi - 3000 psi

Operating Temperatures:
-20°F to 400°F
(-29°C to 204°C)

End Connections:
NPT Threaded

Materials:
Ductile Iron

Features

- Full Opening
- 316 Stainless Steel Trim
- Peroxide Cured Buna Primary Seat Seals
  Metal-to-Metal Secondary Seal
- FKM Seals (Optional)
- NACE MR0175 (2002)
- Horizontal or Vertical Flow-Up Service

WHEATLEY® WAFER CHECK VALVES

Economical and compact. Ideal for close quarter applications where a full body check valve will not fit.

Sizes: 2 in. - 12 in. (50 mm - 300 mm)

Pressure Classes: ASME 150 - 1500

Operating Temperatures: -20°F to 400°F (-29°C to 204°C)

End Connections:
Flanged End RFFE & RTJ

Materials:
Carbon Steel, Stainless Steel

Features

- Compact Design
- Serrated O-Ring Face (Short Pattern)
- 316 Stainless Steel Trim 2 in. - 6 in. (50 mm - 150 mm)
  Short Pattern & Long Pattern
- Carbon Steel with Zinc Plating Trim
  8 in. - 12 in. (200 mm - 300 mm) Short Pattern
- FKM Seals (Optional)
- NACE MR0175 (2002) (Long Pattern)

WHEATLEY® DPV SWING CHECKS

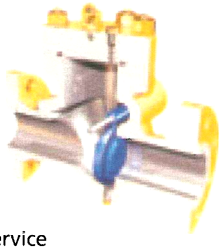
WHEATLEY Check Valves will satisfy your needs for a Drilling/Production service valve.

Sizes: 2 in. - 4 in. (50 mm - 100 mm)

Pressure Classes: ASME 2000, 3000 & 5000

Operating Temperatures: -20°F to 400°F (-29°C to 204°C)

End Connections: RTJ Flanged



Materials: Carbon Steel

Features

- 316 Stainless Steel Trim
- FKM Seals
- Fully Machined Cast on Flanges
- NACE MR0175 (2002)
- Horizontal or Vertical Flow-Up Service

WHEATLEY® API 6D SWING CHECKS

When you've been in the business for over 80 years you come to know something about what your customers are looking for.

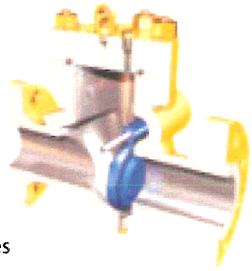
Sizes: 1 in. - 12 in. (25 mm -300 mm)

Pressure Classes: ASME 150 - 2500

Operating Temperatures: -20°F to 400°F (-29°C to 204°C)

End Connections: RFFE or RTJ Flanged

Materials: Carbon Steel, Stainless Steel



Features

- API 6D Monogram
- Full Opening
- Integral and Removable Seat
- 316 Stainless Steel Trim
- Peroxide Cured Buna Seals
- FKM Seals (Optional)
- Fully Machined Cast on Flanges
- NACE MR0175 (2002)
- Horizontal or Vertical Flow-Up Service

TEXSTEAM™ D SERIES PLUG VALVE

Full or Reduced Port design, soft seated non-lubricate. Top entry allows for in-line repair in the field.

Sizes: 1 in. - 4 in. x 3 in. (25 mm -100 mm x 80 mm)

Pressure Classes: ASME 150 - 600

Pressure Ratings: 285 psi - 3000 psi

Operating Temperatures:
-40°F to 400°F (-40°C to 204°C)

End Connections:
RFFE or RTJ Flanged, Threaded End, Weld End

Materials: Carbon Steel, Ductile Iron

Features

- Soft, Resilient DuraSeat™ won't pit or scratch like Teflon or Nylon
- PC Buna-N Seats
- FKM Seats (Optional)
- Bubble-Tight Shut-Off Zero Leakage
- API 6D, B16.34
- NACE MR0175 (2002)
- Large, Rugged Stem with Secure Locking Device to Prevent Tampering
- Quarter Turn with Internal Stops
- Wrench Operated
- NACE MR0175 (2002)

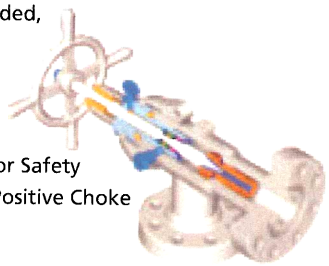
THORNHILL CRAVER® ADJUSTABLE CHOKES

A long-time standard for safety and reliability in the oilfield, THORNHILL CRAVER UNIBOLT™ Stem and Seat Adjustable Chokes are designed for high performance in critical applications such as gas wells with high pressure drops, abrasive flow and corrosive conditions.

Sizes: 2 in. (50 mm) Chokes:
Seat ID 1/2 in. to 1 in. (15 mm to 25 mm)
3 in. (80 mm) Chokes:
Seat ID 1 in. to 2 in. (25 mm to 50 mm)

Pressure Ratings: 2000 psi to 15K psi

End Connections: Threaded,
UNIBOLT Line Pipe,
UNIBOLT Butt Weld,
Flanged API or ASME



Features

- Coupling vs. Threads for Safety
- Simple Conversion to Positive Choke
- Easily Automated
- Easy Maintenance
- Stem Ring for Safety
- Variety of End Connections Available
- Two Seal Designs Utilized
- PLUGLOK Bleeder Plug for Safety and Pressure Release
- Standard Adjustable Choke
- Long Nose Heater Adjustable Choke
- Force Balanced Adjustable Choke

Optional Materials:

Body: 12% Chrome Stainless Steel

Seat/Stems: Alloy Steel, 12% Chrome Stainless Steel and Tungsten Carbide

TEXSTEAM™ SUPER G PLUG VALVE

Single Plug, Double Plug and Compact Manifold Valve designs available. Full and reduced port Metal-to-Metal seating. Top Entry allows for inline repair in the field.

Sizes:
1 in. - 8 in. x 6 in.
(25 mm - 200 mm x 150 mm)

Pressure Classes:
ASME 300 - 2500, API 2000 - 5000

Operating Temperatures:
-50°F to 400°F (-46°C to 204°C)

End Connections: Threaded, RFFE or RTJ Flanged, Weld End Compact Manifold Design

Materials: Carbon Steel, Low Temp Carbon Steel, Duplex

Features

- API 6A, 6D, B16.34
- API 6FA Fire Test
- Regular Port, Full Opening
- Round Ports to Reduce Turbulence
- Lubricated and Non-Lubricated
- Wrench Operated or Actuated
- NACE MR0175 (2002)

THORNHILL CRAVER® POSITIVE CHOKES

A long-time standard for safety and reliability in the oilfield, THORNHILL CRAVER UNIBOLT™ Positive Chokes are designed for maximum performance under critical conditions.

Sizes: 2 in. (50 mm) Chokes:
Bean ID 1/64 in. to 1 in. (0.156 mm to 25 mm)
3 in. (80 mm) Chokes:
Bean ID 1/64 in. to 2 in. (0.156 mm to 50 mm)

Pressure Ratings: 2000 psi to 15K psi

End Connections: Threaded, UNIBOLT Line Pipe,
UNIBOLT Butt Weld,
Flanged API or ASME

Features

- Easy Maintenance
- Coupling vs. Threads for Safety
- Simple Conversion to Adjustable Choke
- Variety of End Connections Available
- Flexible Flow Bean Offering
- Bleeder Plug for Safety and Pressure Release

Optional Materials: Body: 12% Chrome Stainless Steel

Flow Beans: Alloy Steel, 12% Chrome Stainless Steel, Tungsten Carbide and Ceramic Inserts Available

UNIBOLT™ STEEL COUPLINGS

Maximizing leverage for strong connections, THORNHILL CRAVER UNIBOLT Couplings are the high-pressure, compact and light-weight alternative to API or ASME flanges for piping systems.

Sizes: 2 in. to 6 in. (50 mm to 150 mm)

Pressure Ratings: up to 15,000 lbs. CWP

End Connections:

Threaded or Butt Weld: 3000, 5000 lbs. CWP

Butt Weld Only: 10,000, 15,000 lbs. CWP

Standard Materials: All Steel

CAMERON

VALVES & MEASUREMENT
3250 Briarpark Drive, Suite 300
Houston, Texas 77042
USA Toll Free 800 323 9160

For the most current contact and location information go to: www.c-a-m.com/valvesandmeasurement

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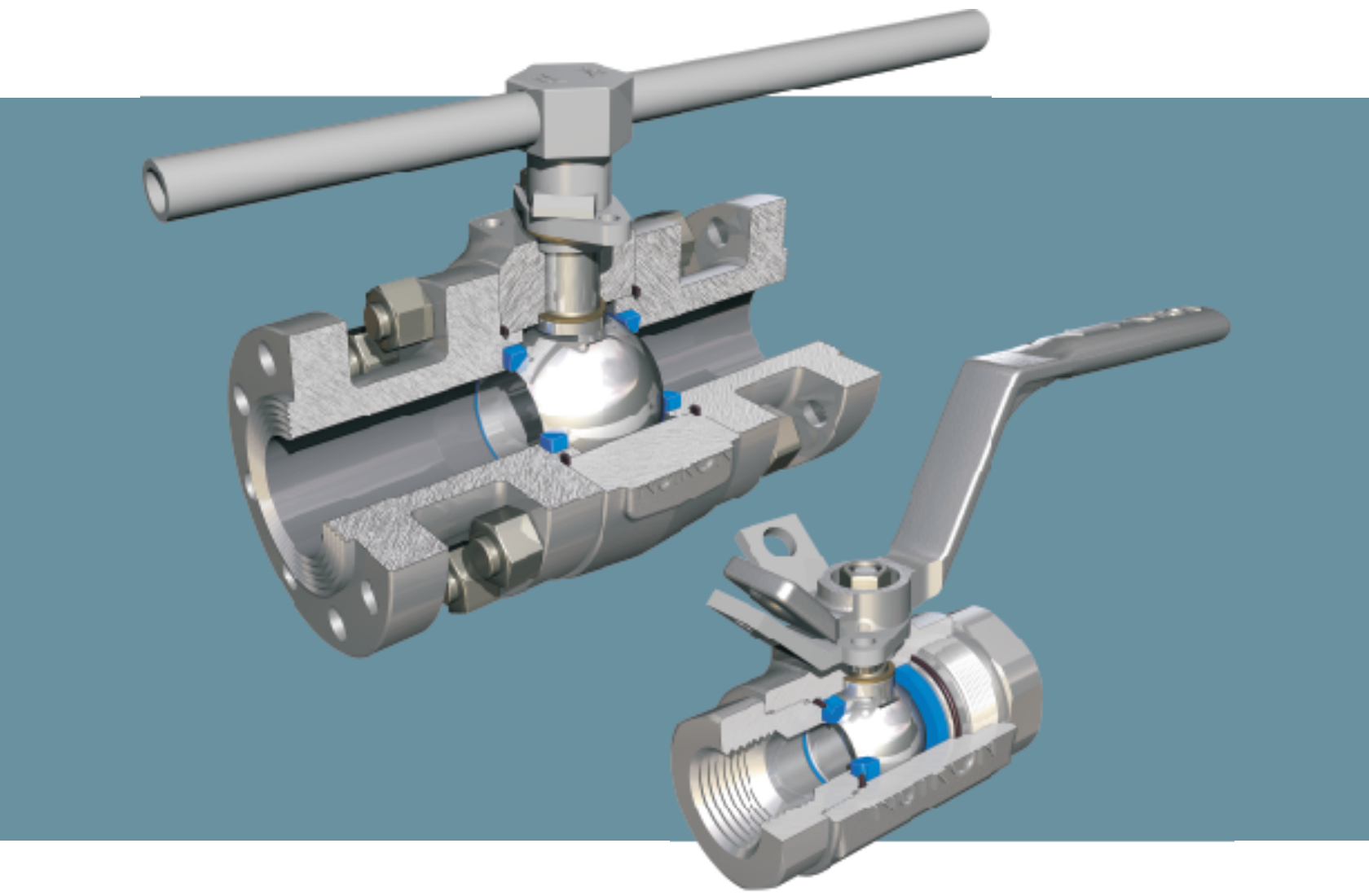
NUTRON® Model T3 & B3 Forged Steel Floating Ball Valves



NUTRON®

TABLE OF CONTENTS

FORGED STEEL FLOATING BALL VALVES

MODEL T3 3 PIECE THREADED FLOATING BALL VALVES

- Full Port sizes 1/2 in. through 3 in. (15 mm through 80 mm)
- Reduced Port sizes 3/4 in. through 4 in. (20 mm through 100 mm)
- ASME Class 150 through 2500 (PN 20 through 420) (see page 3)
- WOG 1000 through 6000 psi (see page 3)
- End Connections: Threaded, Flanged, Socket Weld, Butt Weld

MODEL B3 3 PIECE BOLTED FLOATING BALL VALVES

- Full Port sizes 1 1/2 in. through 4 in. (40 mm through 100 mm)
- Reduced Port sizes 2 in. and 6 in. (50 mm and 150 mm)
- ASME Class 150 through 1500 (PN 20 through 250) (see page 17)
- WOG 2000 and 4000 psi (see page 17)
- End Connections: Flanged, Threaded, Butt Weld

MATERIALS AND ACTUATION

- Materials: Carbon Steel, Stainless Steel, Special Alloys
- Operator: Manual Lever Handle
- Actuation: Consult Cameron, Valves & Measurement Sales Department for information on various types of actuators including; Gear Operators (B3), Pneumatic, Hydro-Pneumatic, Electric, Electro-Pneumatic and Hydraulic

COMPLIANCE TO STANDARDS AND SPECIFICATIONS:

- ISO 9001-2000: Registered Quality System
- ASME B16.34
- API 598 and API 607 4th Edition (Fire Safe)
- CE Mark Number 0879
- ASME Section VIII Division 1 Boiler and Pressure Vessel Code
- CSA Z245.15 Steel Valves
- NACE MR0175 (Rev. 2002)
- Canadian Registration Number (CRN)

FORGED STEEL FLOATING BALL VALVES
STANDARD FEATURES

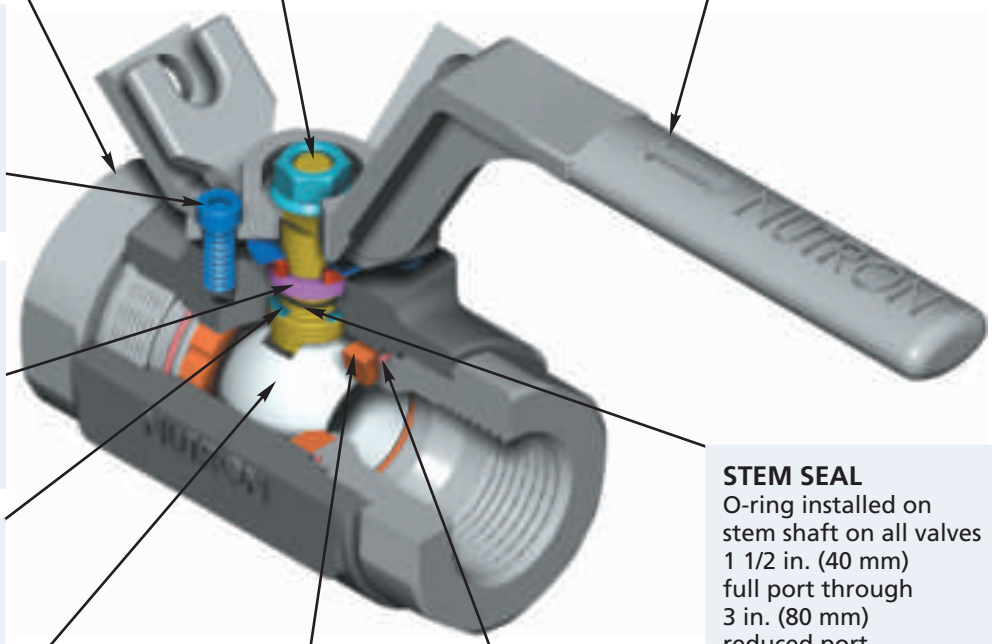
MODEL T3

BODY CONSTRUCTION
Forged steel three piece threaded construction. A machined pad area is drilled and tapped for actuation as a standard. Threaded construction allows for combinations of end connections.

STEM
Blowout proof stem is back-seated through the valve body.

HANDLE
Rugged cast handle.
Handle position indicates flow position.
When the handle is positioned in line with the pipe, the valve is open.
When the handle is positioned perpendicular to the pipe, the valve is closed.
Locking handle is standard for all 2 in. (50 mm) reduced port and smaller valves with either socket weld or FNPT end connections.

CAP SCREWS
Dual purpose; allows for easy stem packing adjustment without handle removal while providing a stop for the handle.



PACKING
Self adjusting by means of a Belleville washer. Allows for long service life before manual packing adjustment is necessary.

STEM SEAL
O-ring installed on stem shaft on all valves 1 1/2 in. (40 mm) full port through 3 in. (80 mm) reduced port.

THRUST WASHER
Acts as a bearing between the body and stem.

BALL
The floating ball design allows for positive shut off in either flow direction.
Includes pressure equalization hole to prevent trapping of pressure in the body cavity.

SEATS
Materials available are Teflon, Delrin, PEEK and Devlon.

BODY SEALS
Body seal O-rings are placed ahead of the body cap threads to protect the threads from the flow media.

FORGED STEEL FLOATING BALL VALVES
MODEL T3 SIZES AVAILABLE

ASME CLASS (PN)		150 (20)	300 (50)	600 (100)	900 (150)	1500 (250)	2500 (420)
Full Port Excluding 1 in. (25 mm)	in. (mm)	1/2 thru 3 (15 thru 80)	1/2 thru 3 (15 thru 80)	1/2 thru 2 (15 thru 50)	1/2 thru 2 (15 thru 50)	1/2 thru 2 (15 thru 50)	1/2 thru 2 (15 thru 50)
Reduced Port Excluding 1 1/2 in. (40 mm)		3/4 thru 4 (20 thru 100)	3/4 thru 4 (20 thru 100)	3/4 thru 3 (20 thru 100)	3/4 thru 3 (20 thru 80)	3/4 thru 3 (20 thru 80)	3/4 thru 3 (20 thru 80)
WOG (psi)			**1000**	**2000**	**3000**	**4000**	**6000**
Full Port, Threaded	in. (mm)		3 (80)	1/4 thru 3 (8 thru 80)	1/4 thru 2 (8 thru 50)	1/4 thru 2 (8 thru 50)	1/4 thru 2 (8 thru 50)
Reduced Port, Threaded			4 (100)	3/4 thru 3 (20 thru 80)	3/4 thru 3 (20 thru 80)	3/4 thru 3 (20 thru 80)	3/4 thru 3 (20 thru 80)
Full Port, Socket Weld				1/2 thru 2 (15 thru 50)	1/2 thru 2 (15 thru 50)	1/2 thru 2 (15 thru 50)	1/2 thru 2 (15 thru 50)
Reduced Port, Socket Weld				3/4 thru 3 (20 thru 80)	3/4 thru 3 (20 thru 80)	3/4 thru 3 (20 thru 80)	3/4 thru 3 (20 thru 80)

ORDERING INFORMATION

How to develop typical figure numbers without options:

MODEL
T3 - 3 PIECE THREADED

BORE
F - FULL PORT
R - REDUCED PORT

SIZE in. (mm)

02 - 1/4 (8)	15 - 1 1/2 (40)
03 - 3/8 (10)	20 - 2 (50)
05 - 1/2 (15)	25 - 2 1/2 (65)
07 - 3/4 (20)	30 - 3 (80)
10 - 1 (25)	40 - 4 (100)
12 - 1 1/4 (32)	

***STYLE**

A - STAINLESS STEEL -50°F (-46°C)	L - SOUR LOW TEMP -50°F (-46°C)
B - STANDARD	N - MONEL STEEL -150°F (-100°C)
D - FULL STAINLESS STEEL -150°F (-100°C)	Q - DUPLEX STEEL -60°F (-51°C)
G - STEAM HIGH TEMP/SOUR +600°F (+315°C)	S - SOUR -20°F (-29°C)
H - HIGH TEMP/SOUR +500°F (+260°C)	

T3 - F 07 S 20 S Z

END CONNECTION

A - RF SMOOTH FACE	H - FNPT X RTJ
B - BW SCH 40	J - RTJ
C - BW SCH 80	M - MALE NPT
D - BW SCH 160	R - RAISED FACE
E - BW SCH XXH	S - FEMALE NPT
F - FNPT X MNPT	TS - FNPT X SOCKET WELD
G - FNPT X RF	WS - SOCKET WELD

PRESSURE

10 - 1000 WOG	01 - 150 ASME
20 - 2000 WOG	03 - 300 ASME
30 - 3000 WOG	06 - 600 ASME
40 - 4000 WOG	09 - 900 ASME
60 - 6000 WOG	15 - 1500 ASME
	25 - 2500 ASME

FIRE SAFE

***COMMON OPTIONS**

ANTI-STATIC SPRING
BLEEDER HOLE
BLEEDER VALVE
CARR. SEAL CLOSE
CARR. SEAL OPEN
DELRIN SEATS
DEVLON SEATS
ELECTROLESS NICKEL PLATING (ENP)
EXTENDED STEM
GRAPHITE PACKING
HSN O-RINGS
IMPREGLON COATING
LOCKING HANDLE
NITRILE O-RINGS
PEEK SEATS
SEAL WELDED
SEAL INJECTION
SPRING RETURN HANDLE
TAC WELD CAP
TEFLON O-RINGS
VITON O-RINGS

Examples:

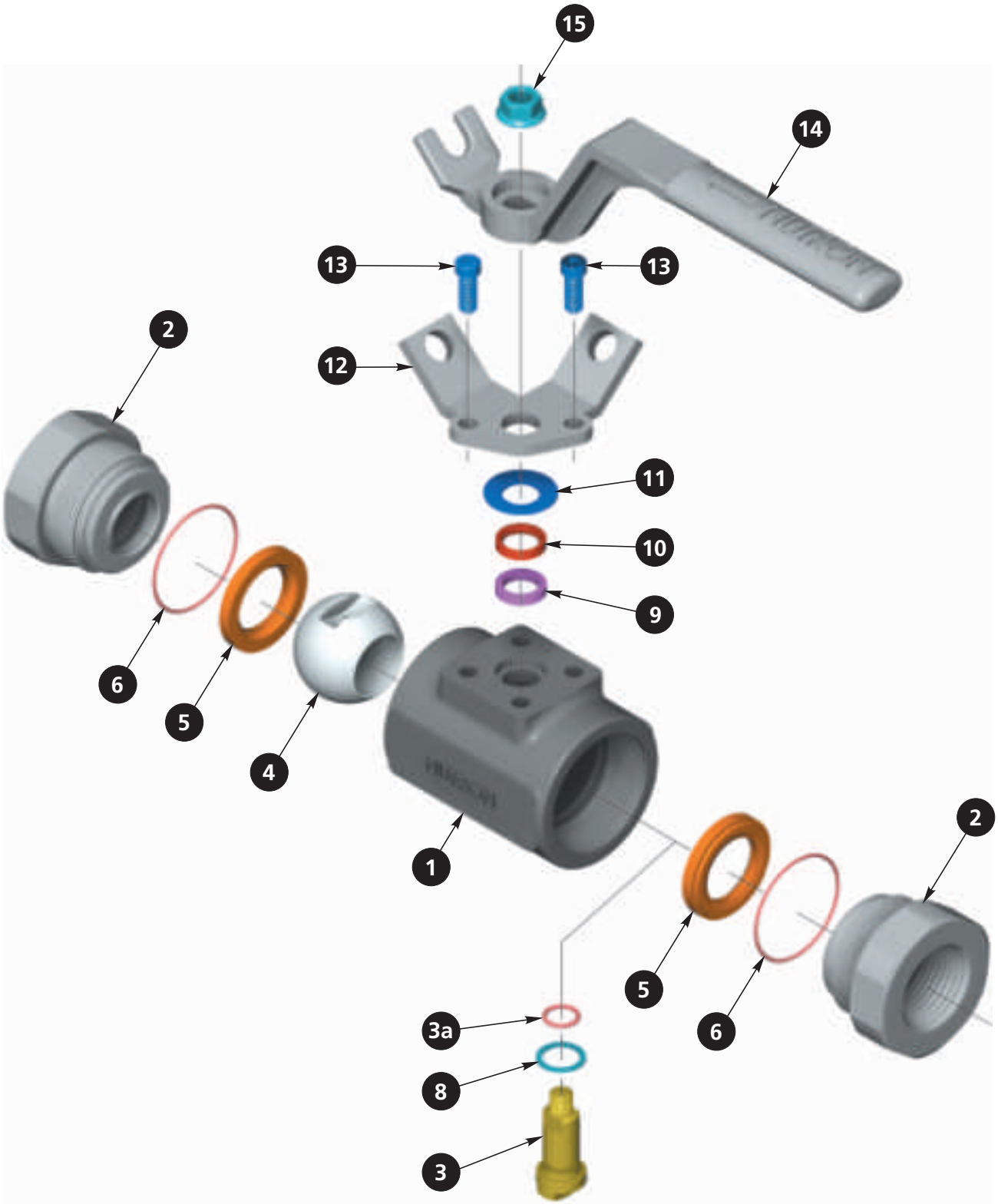
T3-F07S20SZ = Model T3, Full Port, 3/4 in. (20 mm), Female NPT, 2000 WOG, Sour Valve, Fire Safe.

T3-R10TS30B = Model T3, Reduced Port, 1 in. (25 mm), Female NPT x Socket Weld, 3000 WOG, Standard Valve.

* Consult Cameron, Valves & Measurement Sales Department for detailed valve style descriptions, full range of options, materials, actuation packages or for a particular special valve service application.

Cameron reserves the right to substitute materials listed on the following pages with alternate materials for the designated service.

FORGED STEEL FLOATING BALL VALVES
MODEL T3 THREADED END CONNECTIONS



FORGED STEEL FLOATING BALL VALVES
MODEL T3 MATERIALS LIST - THREADED END CONNECTIONS

	ITEM	PART	WORKING PRESSURE	STANDARD -20°F (-29°C)	SOUR -20°F (-29°C)
	1	Body	All	ASTM A105	ASTM A105
	2	End Caps	All	ASTM A105	ASTM A105
■	3	Stem	2000 & 3000 4000 & 6000	ASTM A108, Plated ASTM A564 17-4PH	ASTM A564 17-4PH ASTM A564 17-4PH
■•	3a*	Stem O-Ring	All	Buna	HSN
■	4	Ball	2000, 3000 & 4000 6000	Carbon Steel, Chrome Plated ASTM A564 17-4PH	ASTM A351 Gr. CF8M ASTM A564 17-4PH
■•	5	Seats	2000 3000 & 4000 6000	Teflon Delrin PEEK	Teflon Delrin PEEK
■•	6	Body O-Rings	All	Buna	HSN
■•	8	Thrust Washer	2000 3000 & 4000 6000	Teflon Delrin PEEK	Teflon Delrin PEEK
■•	9	Packing	All	Teflon	Teflon
	10	Packing Follower	All	Carbon Steel, Plated	Stainless Steel
	11	Belleville Washer	All	Carbon Steel	Stainless Steel
	12	Gland Flange **	All	Carbon Steel, Plated	Carbon Steel, Plated
	13	Cap Screws	All	Carbon Steel	Stainless Steel
	14	Handle	All	Carbon Steel	Carbon Steel
	15	Handle Nut	All	Carbon Steel, Plated	Carbon Steel, Plated

	ITEM	PART	WORKING PRESSURE	SOUR & LOW TEMP -50°F (-46°C)	STAINLESS STEEL -50°F (-46°C)
	1	Body	All	ASTM A350 LF2	ASTM A479 TYPE 316
	2	End Caps	All	ASTM A350 LF2	ASTM A479 TYPE 316
■	3	Stem	All	ASTM A564 17-4PH	ASTM A564 17-4PH with Nitriding
■•	3a*	Stem O-Ring	All	HSN	HSN
■	4	Ball	2000 3000 & 4000 6000	ASTM A351 Gr. CF8M ASTM A351 Gr. CF8M ASTM A564 17-4PH	ASTM A351 Gr. CF8M ASTM A564 17-4PH ASTM A564 17-4PH
■•	5	Seats	2000 3000 & 4000 6000	Teflon Delrin PEEK	Teflon PEEK PEEK
■•	6	Body O-Rings	All	HSN	Teflon
■•	8	Thrust Washer	2000 3000 & 4000 6000	Teflon Delrin PEEK	Teflon PEEK PEEK
■•	9	Packing	All	Teflon	Teflon
	10	Packing Follower	All	Stainless Steel	Stainless Steel
	11	Belleville Washer	All	Stainless Steel	Stainless Steel
	12	Gland Flange **	All	Carbon Steel, Plated	Carbon Steel, Plated
	13	Cap Screws	All	Stainless Steel	Stainless Steel
	14	Handle	All	Carbon Steel	Carbon Steel
	15	Handle Nut	All	Carbon Steel, Plated	Carbon Steel, Plated

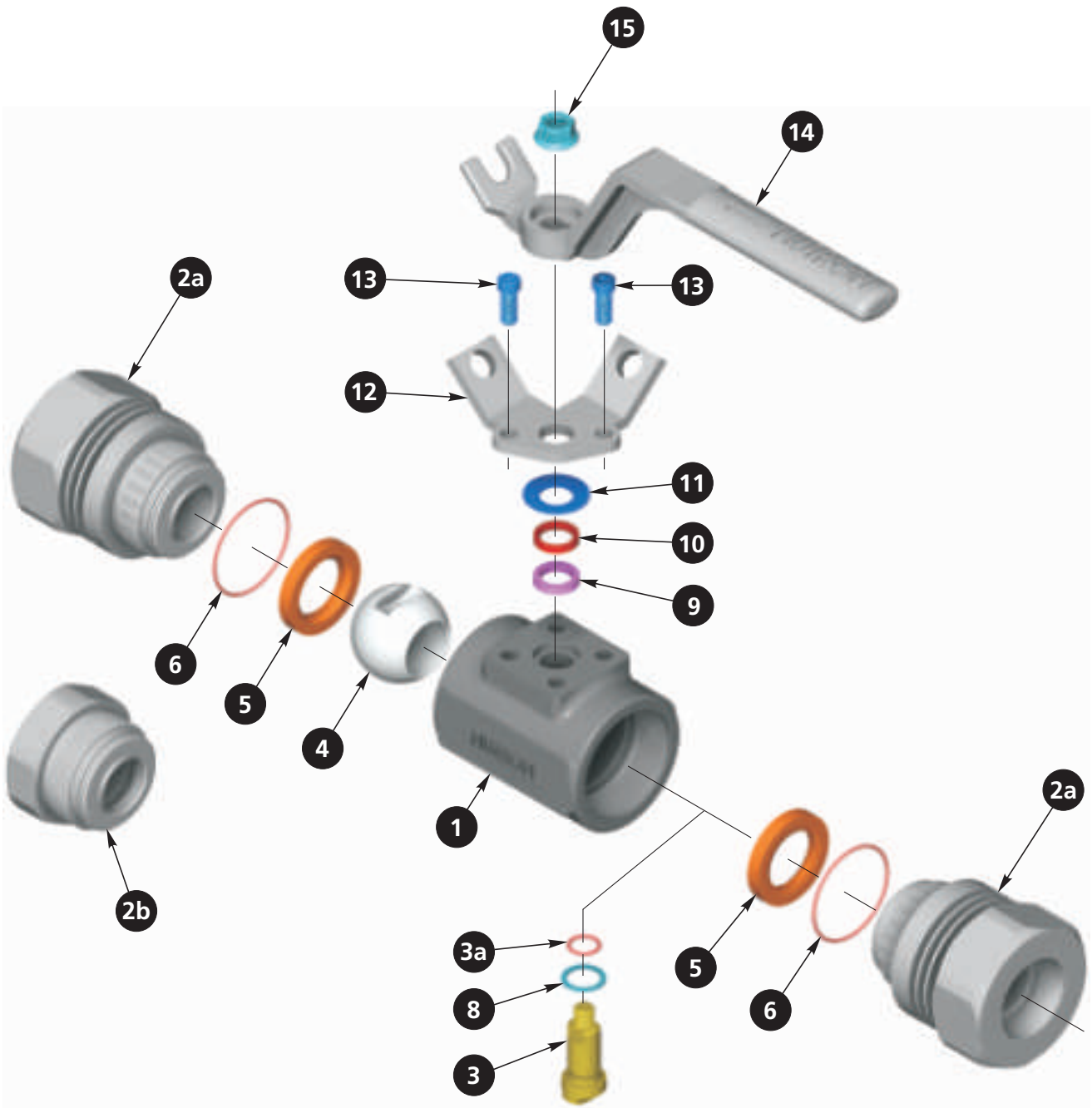
■ Major repair kit.
• Minor repair kit.

* Item 3a is only available on sizes 1 1/2 in. full port through 3 in. reduced port (40 mm through 80 mm) valves.

** Locking device is standard on 1/4 in. full port through 2 in. reduced port (8 mm through 50 mm) valves.

Note: Fire safe trim offered as standard whenever possible.
Consult Cameron, Valves & Measurement Sales Department for fire safe trim.

FORGED STEEL FLOATING BALL VALVES
MODEL T3 SOCKET WELD and
THREADED x SOCKET WELD END CONNECTIONS



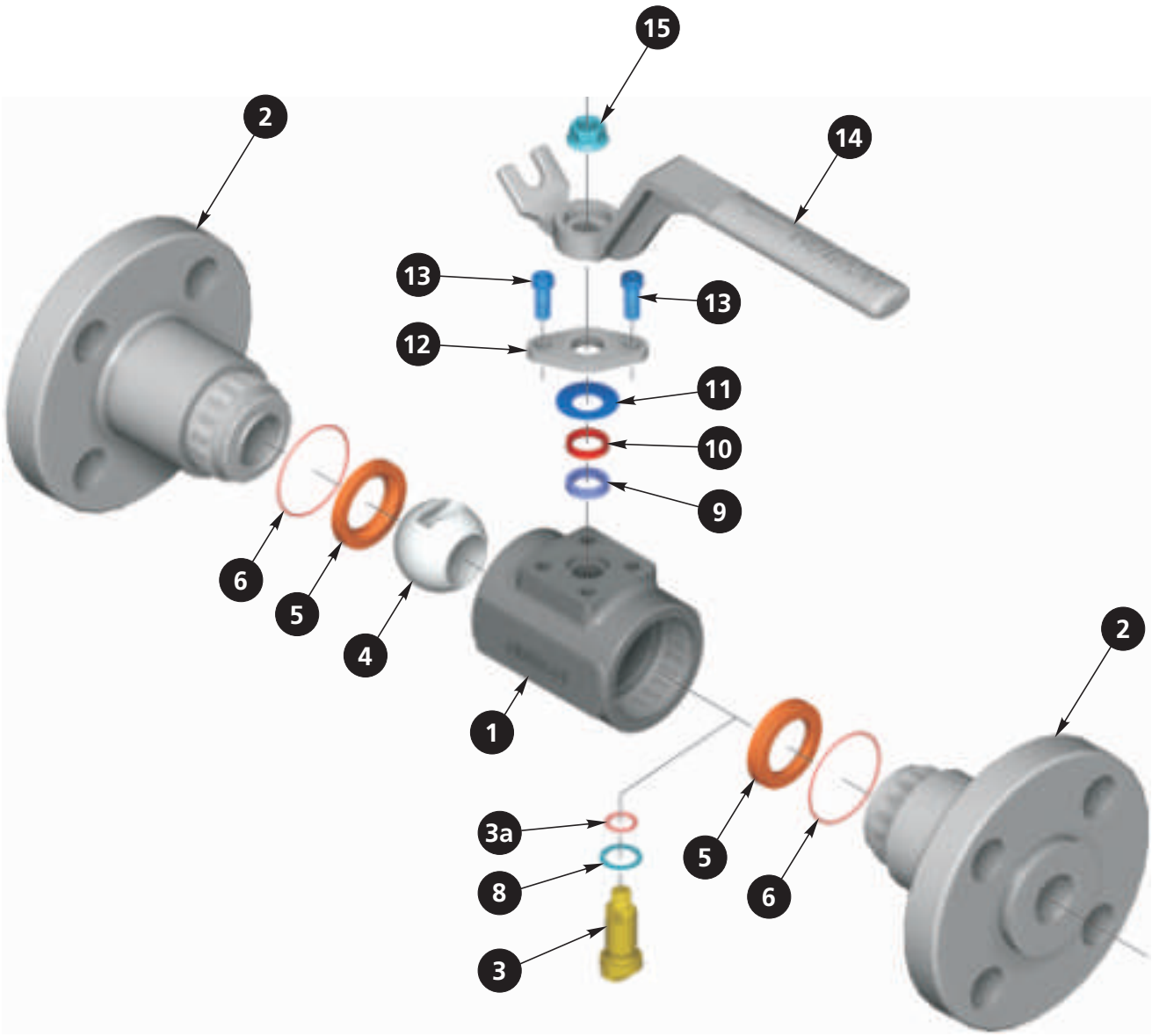
FORGED STEEL FLOATING BALL VALVES
MODEL T3 MATERIALS LIST
SOCKET WELD and THREADED x SOCKET WELD END CONNECTIONS

ITEM	PART	WORKING PRESSURE	STANDARD -20°F (-29°C)	SOUR -20°F (-29°C)
1	Body	All	ASTM A105	ASTM A105
2a	End Caps - SW	All	ASTM A350 Gr. LF2	ASTM A350 Gr. LF2
2b	End Cap - NPT	All	ASTM A105	ASTM A105
■ 3	Stem	2000 & 3000 4000 & 6000	ASTM A108, Plated ASTM A564 17-4PH	ASTM A564 17-4PH ASTM A564 17-4PH
■• 3a*	Stem O-Ring	All	HSN	Viton
■ 4	Ball	2000 3000, 4000 & 6000	ASTM A351 Gr. CF8M ASTM A564 17-4PH	ASTM A351 Gr. CF8M ASTM A564 17-4PH
■• 5	Seats	2000 3000, 4000 & 6000	Teflon PEEK	Teflon PEEK
■• 6	Body O-Rings	All	Viton	Viton
■• 8	Thrust Washer	2000 3000, 4000 & 6000	Teflon PEEK	Teflon PEEK
■• 9	Packing	All	Teflon	Teflon
10	Packing Follower	All	Carbon Steel, Plated	Stainless Steel
11	Belleville Washer	All	Carbon Steel	Stainless Steel
12	Gland Flange **	All	Carbon Steel, Plated	Carbon Steel, Plated
13	Cap Screws	All	Carbon Steel	Stainless Steel
14	Handle	All	Carbon Steel	Carbon Steel
15	Handle Nut	All	Carbon Steel, Plated	Carbon Steel, Plated

ITEM	PART	WORKING PRESSURE	SOUR & LOW TEMP -50°F (-46°C)	STAINLESS STEEL -50°F (-46°C)
1	Body	All	ASTM A350 LF2	ASTM A479 TYPE 316
2a	End Caps - SW	All	ASTM A350 LF2	ASTM A479 TYPE 316 L
2b	End Cap - NPT	All	ASTM A350 LF2	ASTM A479 TYPE 316
■ 3	Stem	All	ASTM A564 17-4PH	ASTM A564 17-4PH with Nitriding
■• 3a*	Stem O-Ring	All	Viton	HSN
■ 4	Ball	2000 3000, 4000 & 6000	ASTM A351 Gr. CF8M ASTM A564 17-4PH	ASTM A351 Gr. CF8M ASTM A564 17-4PH
■• 5	Seats	2000 3000, 4000 & 6000	Teflon PEEK	Teflon PEEK
■• 6	Body O-Rings	All	Viton	Teflon
■• 8	Thrust Washer	2000 3000, 4000 & 6000	Teflon PEEK	Teflon PEEK
■• 9	Packing	All	Teflon	Teflon
10	Packing Follower	All	Stainless Steel	Stainless Steel
11	Belleville Washer	All	Stainless Steel	Stainless Steel
12	Gland Flange **	All	Carbon Steel, Plated	Carbon Steel, Plated
13	Cap Screws	All	Stainless Steel	Stainless Steel
14	Handle	All	Carbon Steel	Carbon Steel
15	Handle Nut	All	Carbon Steel, Plated	Carbon Steel, Plated

■ Major repair kit.
• Minor repair kit.
* Item 3a is only available on sizes 1 1/2 in. full port through 3 in. reduced port (40 mm through 80 mm) valves.
** Locking device is standard on 1/4 in. full port through 2 in. reduced port (8 mm through 50 mm) valves.
Note: Fire safe trim offered as standard whenever possible.
Consult Cameron, Valves & Measurement Sales Department for fire safe trim.

FORGED STEEL FLOATING BALL VALVES
MODEL T3 FLANGED END CONNECTIONS



FORGED STEEL FLOATING BALL VALVES
MODEL T3 MATERIALS LIST - FLANGED END CONNECTIONS
ASME CLASS 150 THROUGH 2500 (PN 20 THROUGH 420)

ITEM	PART	ASME CLASS	STANDARD -20°F (-29°F)	SOUR -20°F (-29°C)
1	Body	All	ASTM A105	ASTM A105
2	End Caps	All	ASTM A105	ASTM A105
■ 3	Stem	150, 300, 600 & 900 1500 & 2500	ASTM A108, Plated ASTM A564 17-4PH	ASTM A564 17-4PH ASTM A564 17-4PH
■• 3a*	Stem O-Ring	All	Buna	HSN
■ 4	Ball	150 thru 1500 2500	Carbon Steel, Chrome Plated ASTM A564 17-4PH	ASTM A351 Gr. CF8M ASTM A564 17-4PH
■• 5	Seats	150, 300 & 600 900 & 1500 2500	Teflon Delrin PEEK	Teflon Delrin PEEK
■• 6	Body O-Rings	All	Buna	HSN
■• 8	Thrust Washer	150, 300 & 600 900 & 1500 2500	Teflon Delrin PEEK	Teflon Delrin PEEK
■• 9	Packing	All	Teflon	Teflon
10	Packing Follower	All	Carbon Steel, Plated	Stainless Steel
11	Belleville Washer	All	Carbon Steel	Stainless Steel
12	Gland Flange	All	Carbon Steel, Plated	Carbon Steel, Plated
13	Cap Screws	All	Carbon Steel	Stainless Steel
14	Handle	All	Carbon Steel	Carbon Steel
15	Handle Nut	All	Carbon Steel, Plated	Carbon Steel, Plated

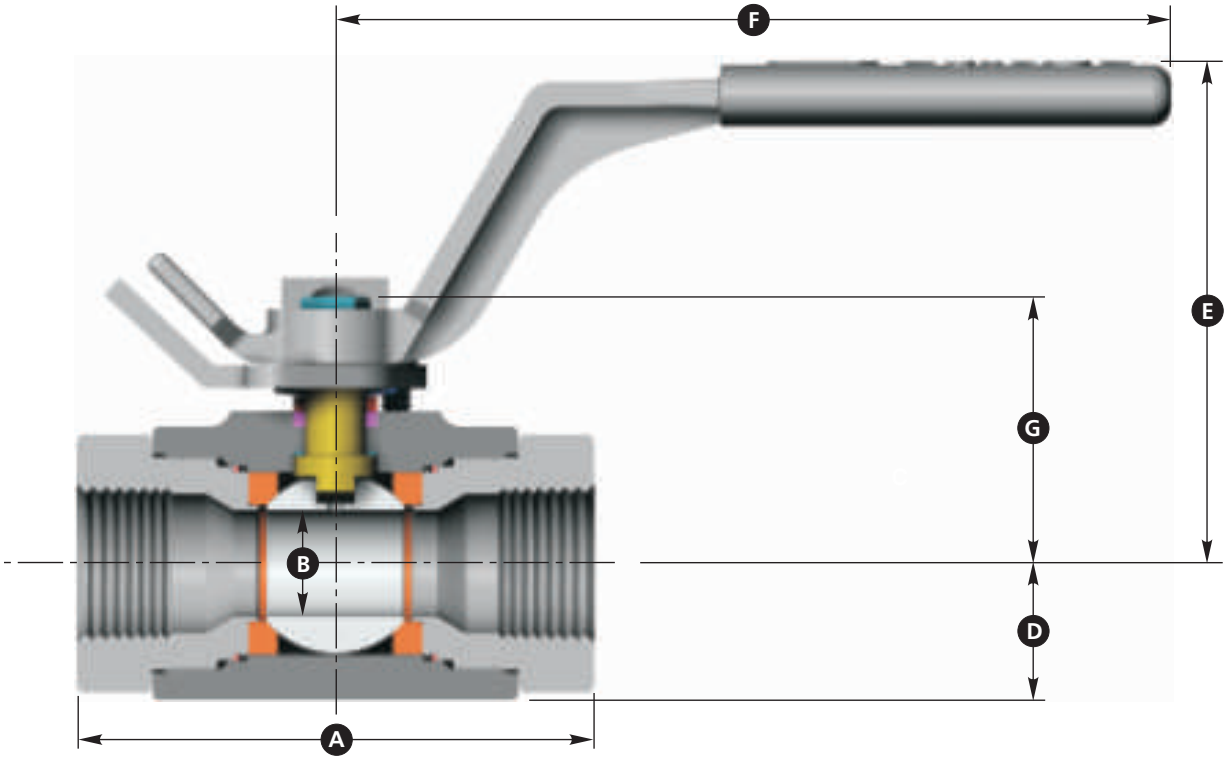
ITEM	PART	ASME CLASS	SOUR & LOW TEMP -50°F (-46°C)	STAINLESS STEEL -50°F (-46°C)
1	Body	All	ASTM A350 LF2	ASTM A479 TYPE 316
2	End Caps	All	ASTM A350 LF2	ASTM A479 TYPE 316
■ 3	Stem	All	ASTM A564 17-4PH	ASTM A564 17-4PH with Nitriding
■• 3a*	Stem O-Ring	All	HSN	HSN
■ 4	Ball	150, 300 & 600 900 & 1500 2500	ASTM A351 Gr. CF8M ASTM A351 Gr. CF8M ASTM A564 17-4PH	ASTM A351 Gr. CF8M ASTM A564 17-4PH ASTM A564 17-4PH
■• 5	Seats	150, 300 & 600 900 & 1500 2500	Teflon Delrin PEEK	Teflon PEEK PEEK
■• 6	Body O-Rings	All	HSN	Teflon
■• 8	Thrust Washer	150, 300 & 600 900 & 1500 2500	Teflon Delrin PEEK	Teflon PEEK PEEK
■• 9	Packing	All	Teflon	Teflon
10	Packing Follower	All	Stainless Steel	Stainless Steel
11	Belleville Washer	All	Stainless Steel	Stainless Steel
12	Gland Flange	All	Carbon Steel, Plated	Carbon Steel, Plated
13	Cap Screws	All	Stainless Steel	Stainless Steel
14	Handle	All	Carbon Steel	Carbon Steel
15	Handle Nut	All	Carbon Steel, Plated	Carbon Steel, Plated

■ Major repair kit.
• Minor repair kit.

* Item 3a is only available on sizes 1 1/2 in. full port through 3 in. reduced port (40 mm through 80 mm) valves.

Note: Fire safe trim offered as standard whenever possible.
Consult Cameron, Valves & Measurement Sales Department for fire safe trim.

FORGED STEEL FLOATING BALL VALVES
MODEL T3 FULL PORT - THREADED



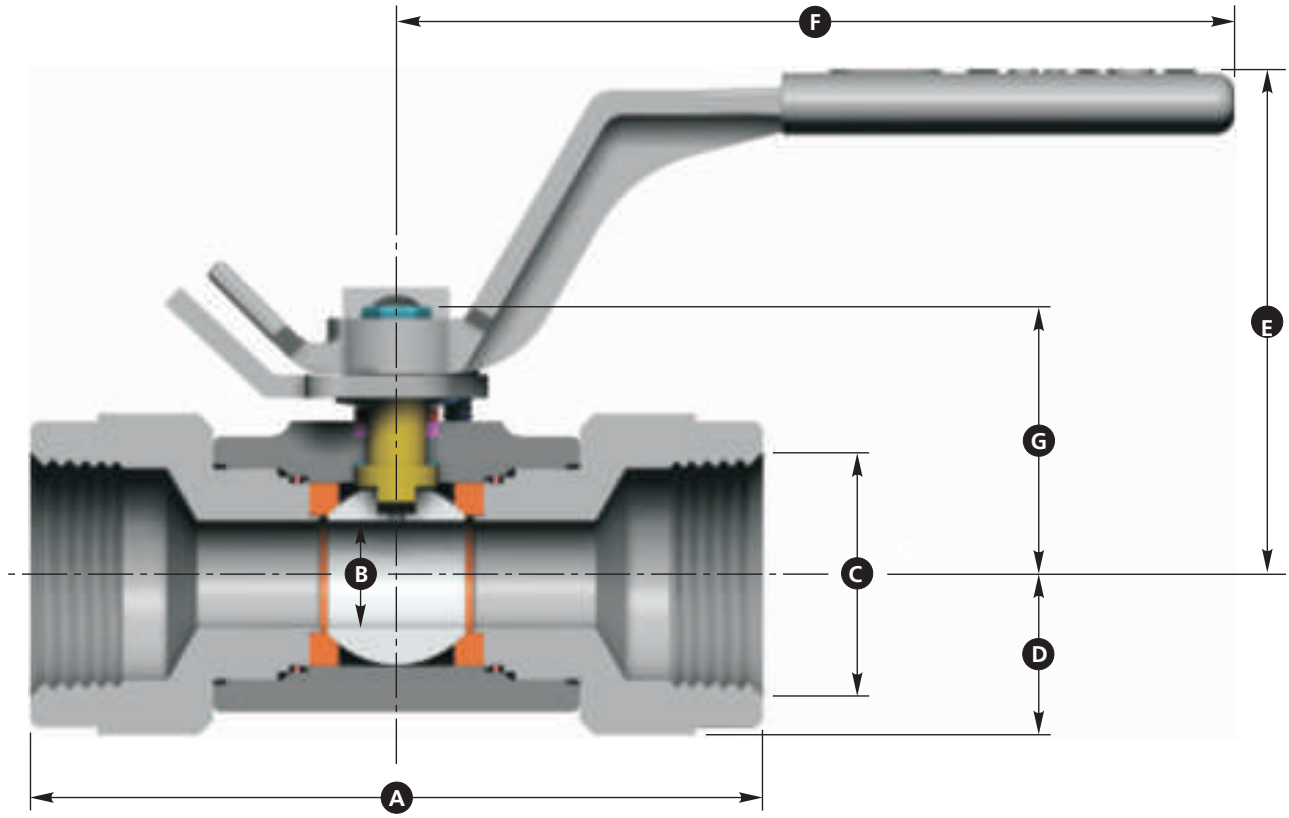
DIMENSIONS

SIZE in. (mm)	WOG	A	B	D	E	F	G	C_v	WEIGHT lb. (kg)
1/4 (8)	2000	3.88 (98)	0.50 (13)	0.82 (21)	3.29 (83)	4.82 (122)	1.73 (44)	9	2.5 (1.1)
	3000	3.88 (98)	0.50 (13)	0.82 (21)	3.29 (83)	4.82 (122)	1.73 (44)	9	2.5 (1.1)
	4000	3.88 (98)	0.50 (13)	0.82 (21)	3.29 (83)	4.82 (122)	1.73 (44)	9	2.5 (1.1)
	6000	3.88 (98)	0.50 (13)	0.82 (21)	3.29 (83)	4.82 (122)	1.73 (44)	9	2.5 (1.1)
3/8 (10)	2000	3.88 (98)	0.50 (13)	0.82 (21)	3.29 (83)	4.82 (122)	1.73 (44)	9	2.4 (1.0)
	3000	3.88 (98)	0.50 (13)	0.82 (21)	3.29 (83)	4.82 (122)	1.73 (44)	9	2.4 (1.0)
	4000	3.88 (98)	0.50 (13)	0.82 (21)	3.29 (83)	4.82 (122)	1.73 (44)	9	2.4 (1.0)
	6000	3.88 (98)	0.50 (13)	0.82 (21)	3.29 (83)	4.82 (122)	1.73 (44)	9	2.4 (1.0)
1/2 (15)	2000	3.88 (98)*	0.50 (13)	0.82 (21)	3.29 (83)	4.82 (122)	1.73 (44)	26	2.2 (0.9)
	3000	3.88 (98)*	0.50 (13)	0.82 (21)	3.29 (83)	4.82 (122)	1.73 (44)	26	2.2 (0.9)
	4000	3.88 (98)*	0.50 (13)	0.82 (21)	3.29 (83)	4.82 (122)	1.73 (44)	26	2.2 (0.9)
	6000	4.38 (111)	0.50 (13)	0.82 (21)	3.29 (83)	4.82 (122)	1.73 (44)	26	2.2 (0.9)
3/4 (20)	2000	4.25 (108)	0.88 (22)	1.12 (29)	4.40 (112)	6.75 (172)	2.16 (55)	50	4.8 (2.1)
	3000	4.25 (108)	0.88 (22)	1.12 (29)	4.40 (112)	6.75 (172)	2.16 (55)	50	4.8 (2.1)
	4000	4.25 (108)	0.88 (22)	1.12 (29)	4.40 (112)	6.75 (172)	2.16 (55)	50	4.8 (2.1)
	6000	4.25 (108)	0.88 (22)	1.50 (38)	4.40 (112)	6.75 (172)	2.16 (55)	50	6.5 (2.9)
1 1/2 (40)	2000	6.25 (159)	1.50 (38)	1.98 (50)	5.62 (143)	11.00 (279)	3.52 (89)	260	18.0 (8.1)
	3000	6.25 (159)	1.50 (38)	1.98 (50)	5.62 (143)	11.00 (279)	3.52 (89)	260	18.0 (8.1)
	4000	6.25 (159)	1.50 (38)	1.98 (50)	5.62 (143)	11.00 (279)	3.52 (89)	260	18.0 (8.1)
	6000	6.25 (159)	1.50 (38)	1.98 (50)	5.62 (143)	11.00 (279)	3.52 (89)	260	18.0 (8.1)
2 (50)	2000	6.25 (159)	2.00 (51)	2.53 (64)	6.96 (177)	11.88 (302)	4.83 (123)	480	30.0 (13.6)
	3000	6.25 (159)	2.00 (51)	2.53 (64)	6.96 (177)	11.88 (302)	4.83 (123)	480	30.0 (13.6)
	4000	6.25 (159)	2.00 (51)	2.53 (64)	6.96 (177)	11.88 (302)	4.83 (123)	480	30.0 (13.6)
	6000	6.25 (159)	2.00 (51)	2.53 (64)	6.96 (177)	11.88 (302)	4.83 (123)	480	30.0 (13.6)
3 (80)	1000	9.70 (246)	3.00 (76)	3.50 (89)	8.26 (210)	23.88 (607)	5.37 (137)	1300	67.0 (30.4)
	2000	9.70 (246)	3.00 (76)	3.50 (89)	8.26 (210)	23.88 (607)	5.37 (137)	1300	67.0 (30.4)

* 4.38 in. (111 mm) for Stainless Steel valves.

NOTE: " A " dimension to be within ± 0.062 in. (1.5 mm).

FORGED STEEL FLOATING BALL VALVES
MODEL T3 REDUCED PORT - THREADED

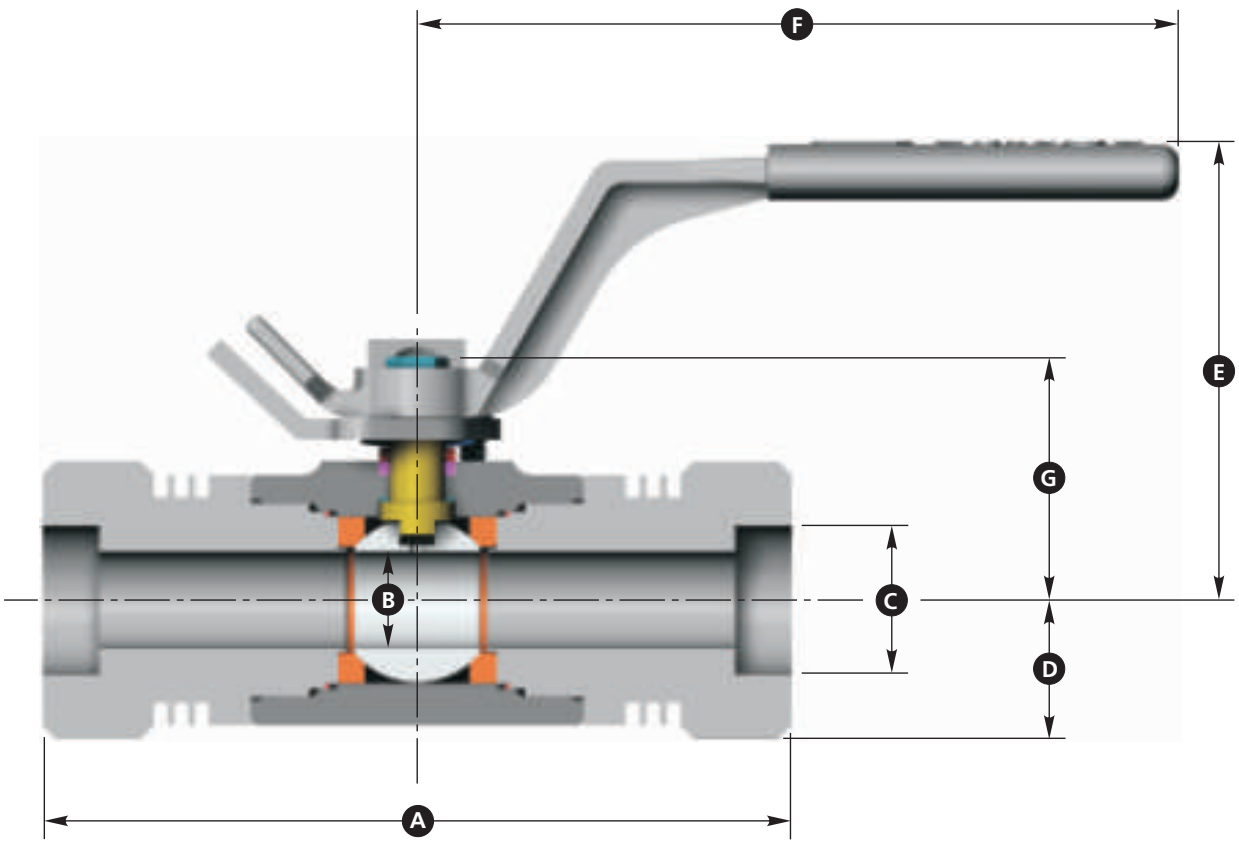


DIMENSIONS

SIZE in. (mm)	WOG	A	B	C	D	E	F	G	C_v	WEIGHT lb. (kg)
3/4 (20)	2000	4.38 (111)	0.50 (13)	0.75 (19)	0.82 (21)	3.29 (83)	4.82 (122)	1.73 (44)	14	2.5 (1.1)
	3000	4.38 (111)	0.50 (13)	0.75 (19)	0.82 (21)	3.29 (83)	4.82 (122)	1.73 (44)	14	2.5 (1.1)
	4000	4.38 (111)	0.50 (13)	0.75 (19)	0.82 (21)	3.29 (83)	4.82 (122)	1.73 (44)	14	2.5 (1.1)
	6000	4.38 (111)	0.50 (13)	0.75 (19)	0.82 (21)	3.29 (83)	4.82 (122)	1.73 (44)	14	2.5 (1.1)
1 (25)	2000	4.25 (108)	0.88 (22)	1.00 (25)	1.12 (28)	4.40 (112)	6.75 (172)	2.16 (55)	35	4.5 (2.0)
	3000	4.25 (108)	0.88 (22)	1.00 (25)	1.12 (28)	4.40 (112)	6.75 (172)	2.16 (55)	35	4.5 (2.0)
	4000	4.25 (108)	0.88 (22)	1.00 (25)	1.12 (28)	4.40 (112)	6.75 (172)	2.16 (55)	35	4.5 (2.0)
	6000	5.25 (133)	0.88 (22)	1.00 (25)	1.50 (38)	4.40 (112)	6.75 (172)	2.16 (55)	35	7.5 (3.4)
1 1/4 (32)	2000	6.00 (152)	0.88 (22)	1.25 (32)	1.30 (33)	4.40 (112)	6.75 (172)	2.16 (55)	35	8.0 (3.6)
	3000	6.00 (152)	0.88 (22)	1.25 (32)	1.30 (33)	4.40 (112)	6.75 (172)	2.16 (55)	35	8.0 (3.6)
2 (50)	2000	6.25 (159)	1.50 (38)	2.00 (51)	1.98 (50)	5.62 (143)	11.00 (279)	3.52 (89)	100	17.5 (7.9)
	3000	6.25 (159)	1.50 (38)	2.00 (51)	1.98 (50)	5.62 (143)	11.00 (279)	3.52 (89)	100	17.5 (7.9)
	4000	6.25 (159)	1.50 (38)	2.00 (51)	1.98 (50)	5.62 (143)	11.00 (279)	3.52 (89)	100	17.5 (7.9)
	6000	7.25 (184)	1.50 (38)	2.00 (51)	1.98 (50)	5.62 (143)	11.00 (279)	3.52 (89)	100	21.0 (9.5)
3 (80)	2000	10.0 (254)	2.00 (51)	3.00 (76)	2.53 (64)	6.96 (177)	11.88 (302)	4.83 (123)	420	39.0 (17.6)
	3000	10.0 (254)	2.00 (51)	3.00 (76)	2.53 (64)	6.96 (177)	11.88 (302)	4.83 (123)	420	39.0 (17.6)
	4000	10.0 (254)	2.00 (51)	3.00 (76)	2.53 (64)	6.96 (177)	11.88 (302)	4.83 (123)	420	39.0 (17.6)
	6000	10.0 (254)	2.00 (51)	3.00 (76)	2.53 (64)	6.96 (177)	11.88 (302)	4.83 (123)	420	48.0 (21.8)
4 (100)	1000	9.5 (241)	3.00 (76)	4.00 (102)	3.50 (89)	8.26 (210)	23.88 (607)	5.37 (137)	770	80.0 (36.3)

NOTE: " A " dimension to be within ± 0.062 in. (1.5 mm).

FORGED STEEL FLOATING BALL VALVES
MODEL T3 FULL PORT - SOCKET WELD & THREADED x SOCKET WELD



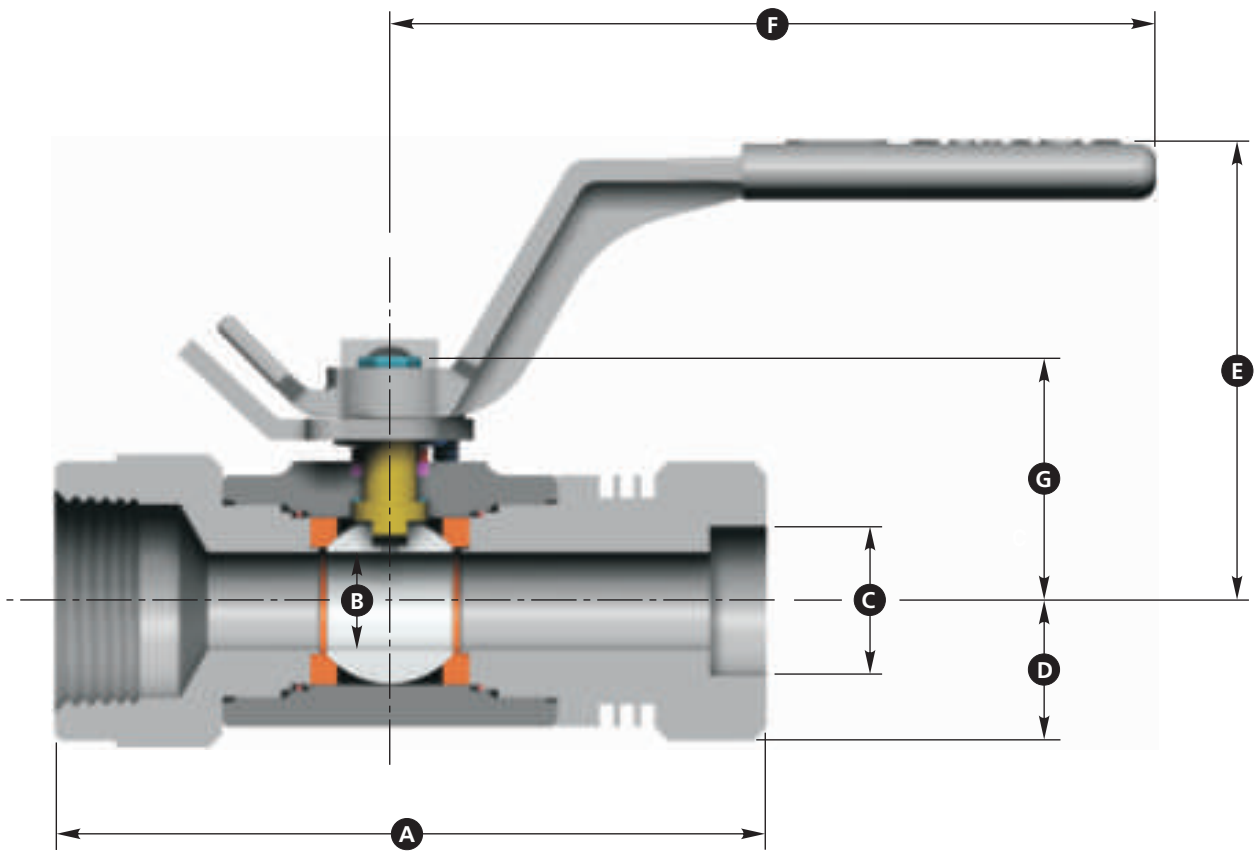
DIMENSIONS

SIZE in. (mm)	WOG	A FNPT x SW	A SW	B	C FNPT x SW	C SW	D	E	F	G	C_v	WEIGHT lb. (kg) FNPT x SW	WEIGHT lb. (kg) SW
1/2 (15)	2000	4.44 (113)*	5.00 (127)	0.50 (13)	0.50 (13)	0.86 (22)	0.94 (24)	3.29 (83)	4.82 (122)	1.73 (44)	26	3.5 (1.5)	4.8 (2.1)
	3000	4.44 (113)*	5.00 (127)	0.50 (13)	0.50 (13)	0.86 (22)	0.94 (24)	3.29 (83)	4.82 (122)	1.73 (44)	26	3.5 (1.5)	4.8 (2.1)
	4000	4.44 (113)*	5.00 (127)	0.50 (13)	0.50 (13)	0.86 (22)	0.94 (24)	3.29 (83)	4.82 (122)	1.73 (44)	26	3.5 (1.5)	4.8 (2.1)
	6000	4.69 (119)	5.00 (127)	0.50 (13)	0.50 (13)	0.86 (22)	0.94 (24)	3.29 (83)	4.82 (122)	1.73 (44)	26	3.5 (1.5)	4.8 (2.1)
3/4 (20)	2000	5.50 (140)	6.75 (172)	0.88 (22)	0.75 (19)	1.07 (27)	1.25 (32)	4.40 (112)	6.75 (172)	2.16 (55)	50	5.7 (2.5)	6.4 (2.9)
	3000	5.50 (140)	6.75 (172)	0.88 (22)	0.75 (19)	1.07 (27)	1.25 (32)	4.40 (112)	6.75 (172)	2.16 (55)	50	5.7 (2.5)	6.4 (2.9)
	4000	5.50 (140)	6.75 (172)	0.88 (22)	0.75 (19)	1.07 (27)	1.25 (32)	4.40 (112)	6.75 (172)	2.16 (55)	50	5.7 (2.5)	6.4 (2.9)
	6000	5.50 (140)	6.75 (172)	0.88 (22)	0.75 (19)	1.07 (27)	1.50 (38)	4.40 (112)	6.75 (172)	2.16 (55)	50	8.6 (3.9)	9.2 (4.1)
1 1/2 (40)	2000	7.40 (188)	8.54 (217)	1.50 (38)	1.50 (38)	1.92 (49)	2.50 (64)	5.62 (143)	11.00 (279)	3.52 (89)	260	21.9 (9.9)	25.7 (11.6)
	3000	7.40 (188)	8.54 (217)	1.50 (38)	1.50 (38)	1.92 (49)	2.50 (64)	5.62 (143)	11.00 (279)	3.52 (89)	260	21.9 (9.9)	25.7 (11.6)
	4000	7.40 (188)	8.54 (217)	1.50 (38)	1.50 (38)	1.92 (49)	2.50 (64)	5.62 (143)	11.00 (279)	3.52 (89)	260	21.9 (9.9)	25.7 (11.6)
	6000	7.40 (188)	8.54 (217)	1.50 (38)	1.50 (38)	1.92 (49)	2.50 (64)	5.62 (143)	11.00 (279)	3.52 (89)	260	21.9 (9.9)	25.7 (11.6)
2 (50)	2000	9.50 (241)	12.75 (324)	2.00 (51)	2.00 (51)	2.41 (61)	2.53 (64)	6.96 (177)	11.88 (302)	4.83 (123)	480	38.3 (17)	46.5 (21.0)
	3000	9.50 (241)	12.75 (324)	2.00 (51)	2.00 (51)	2.41 (61)	2.53 (64)	6.96 (177)	11.88 (302)	4.83 (123)	480	38.3 (17)	46.5 (21.0)
	4000	9.50 (241)	12.75 (324)	2.00 (51)	2.00 (51)	2.41 (61)	2.53 (64)	6.96 (177)	11.88 (302)	4.83 (123)	480	38.3 (17)	46.5 (21.0)
	6000	9.50 (241)	12.75 (324)	2.00 (51)	2.00 (51)	2.41 (61)	2.53 (64)	6.96 (177)	11.88 (302)	4.83 (123)	480	38.3 (17)	46.5 (21.0)

* 4.69 in. (119.1 mm) for Stainless Steel valves.

NOTE: " A " dimension to be within ± 0.062 in. (1.5 mm).

FORGED STEEL FLOATING BALL VALVES
MODEL T3 REDUCED PORT - SOCKET WELD & THREADED x SOCKET WELD

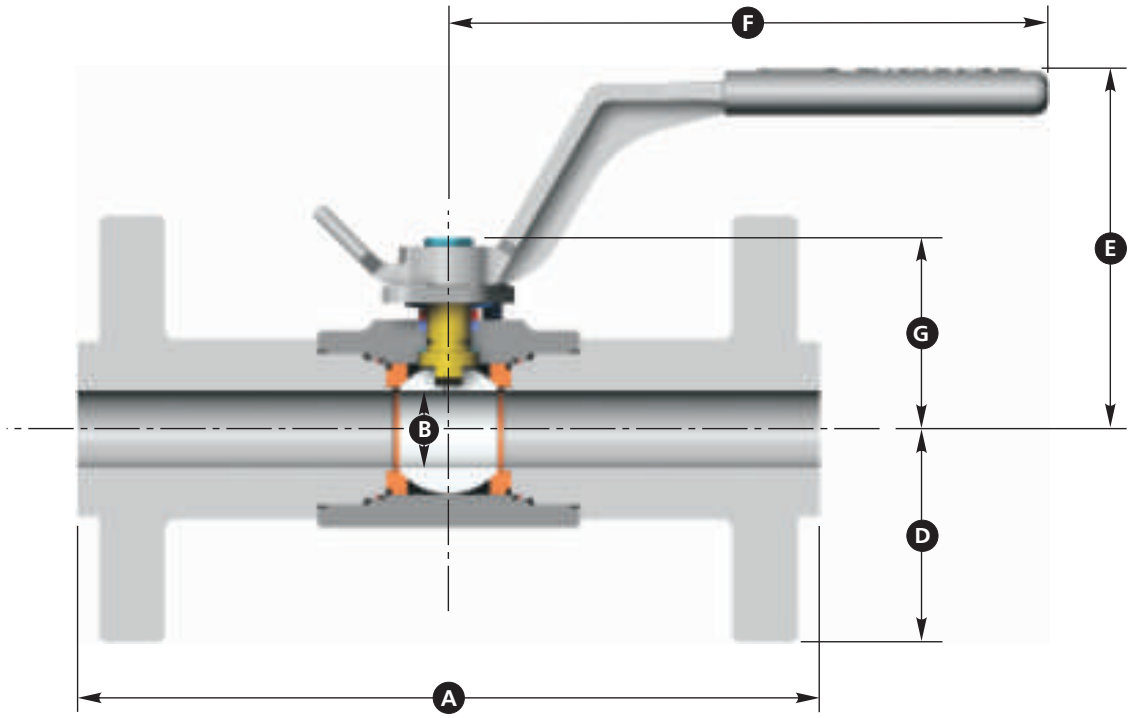


DIMENSIONS

SIZE in. (mm)	WOG	A FNPT x SW	A SW	B	C FNPT x SW	C SW	D	E	F	G	C_v	WEIGHT lb. (kg) FNPT x SW	WEIGHT lb. (kg) SW
3/4 (20)	2000	5.56 (141	6.75 (172)	0.50 (13)	0.75 (19)	1.07 (27)	1.19 (30)	3.29 (83)	4.82 (122)	1.73 (44)	14	3.5 (1.5)	4.4 (1.9)
	3000	5.56 (141)	6.75 (172)	0.50 (13)	0.75 (19)	1.07 (27)	1.19 (30)	3.29 (83)	4.82 (122)	1.73 (44)	14	3.5 (1.5)	4.4 (1.9)
	4000	5.56 (141)	6.75 (172)	0.50 (13)	0.75 (19)	1.07 (27)	1.19 (30)	3.29 (83)	4.82 (122)	1.73 (44)	14	3.5 (1.5)	4.4 (1.9)
	6000	5.56 (141)	6.75 (172)	0.50 (13)	0.75 (19)	1.07 (27)	1.19 (30)	3.29 (83)	4.82 (122)	1.73 (44)	14	3.5 (1.5)	4.4 (1.9)
1 (25)	2000	5.50 (140)*	6.75 (172)	0.88 (22)	1.00 (25)	1.34 (34)	1.25 (32)	4.40 (112)	6.75 (172)	2.16 (55)	35	5.4 (2.4)	6.2 (2.8)
	3000	5.50 (140)*	6.75 (172)	0.88 (22)	1.00 (25)	1.34 (34)	1.25 (32)	4.40 (112)	6.75 (172)	2.16 (55)	35	5.4 (2.4)	6.2 (2.8)
	4000	5.50 (140)*	6.75 (172)	0.88 (22)	1.00 (25)	1.34 (34)	1.25 (32)	4.40 (112)	6.75 (172)	2.16 (55)	35	5.4 (2.4)	6.2 (2.8)
	6000	6.00 (152)	6.75 (172)	0.88 (22)	1.00 (25)	1.34 (34)	1.50 (38)	4.40 (112)	6.75 (172)	2.16 (55)	35	8.3 (3.7)	9.0 (4.0)
2 (50)	2000	7.40 (188)	8.55 (217)	1.50 (38)	2.00 (51)	2.42 (62)	2.50 (64)	5.62 (143)	11.00 (280)	3.52 (90)	100	22.5 (10.2)	26.0 (11.7)
	3000	7.40 (188)	8.55 (217)	1.50 (38)	2.00 (51)	2.42 (62)	2.50 (64)	5.62 (143)	11.00 (280)	3.52 (90)	100	22.5 (10.2)	26.0 (11.7)
	4000	7.40 (188)	8.55 (217)	1.50 (38)	2.00 (51)	2.42 (62)	2.50 (64)	5.62 (143)	11.00 (280)	3.52 (90)	100	22.5 (10.2)	26.0 (11.7)
	6000	7.90 (201)	8.55 (217)	1.50 (38)	2.00 (51)	2.42 (62)	2.50 (64)	5.62 (143)	11.00 (280)	3.52 (90)	100	22.5 (10.2)	26.0 (11.7)
3 (80)	2000	11.38 (289)	12.75 (324)	2.00 (51)	3.00 (76)	3.55 (90)	2.53 (64)	6.96 (177)	11.88 (302)	4.83 (123)	420	49.0 (22.2)	60.0 (27.2)
	3000	11.38 (289)	12.75 (324)	2.00 (51)	3.00 (76)	3.55 (90)	2.53 (64)	6.96 (177)	11.88 (302)	4.83 (123)	420	49.0 (22.2)	60.0 (27.2)
	4000	11.38 (289)	12.75 (324)	2.00 (51)	3.00 (76)	3.55 (90)	2.53 (64)	6.96 (177)	11.88 (302)	4.83 (123)	420	49.0 (22.2)	60.0 (27.2)

* 6.00 in. (152 mm) for Stainless Steel valves. NOTE: " A " dimension to be within ± 0.062 in. (1.5 mm).

FORGED STEEL FLOATING BALL VALVES
MODEL T3 FULL PORT - FLANGED

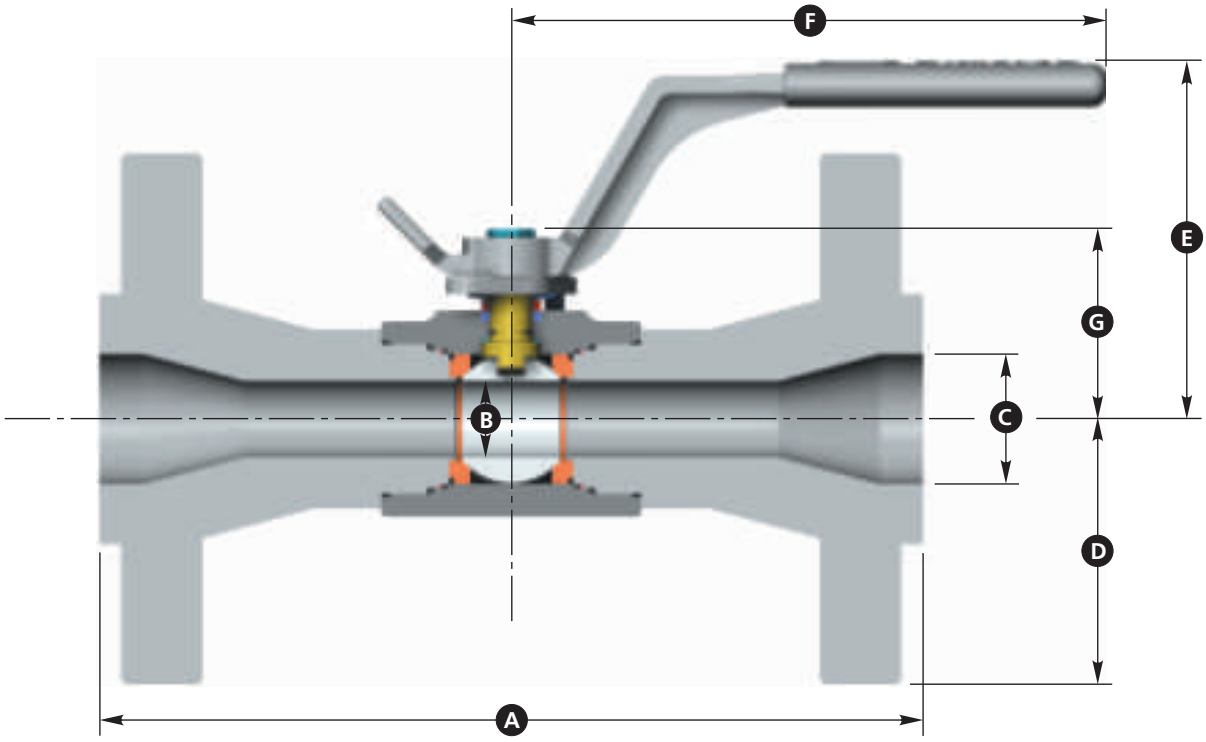


DIMENSIONS

SIZE in. (mm)	ASME CLASS	(PN)	A RF	A RTJ	B	D	E	F	G	C_v	WEIGHT lb. (kg)
1/2 (15)	150	(20)	4.25 (108)	-	0.50 (13)	1.75 (45)	3.29 (83)	4.82 (122)	1.73 (44)	26	4.0 (1.8)
	300	(50)	5.50 (140)	5.94 (151)	0.50 (13)	1.87 (48)	3.29 (83)	4.82 (122)	1.73 (44)	26	4.4 (1.9)
	600	(100)	6.50 (165)	6.50 (165)	0.50 (13)	1.87 (48)	3.29 (83)	4.82 (122)	1.73 (44)	26	5.5 (2.4)
	900/1500	(150/250)	8.50 (216)	8.50 (216)	0.50 (13)	2.37 (60)	5.73 (146)	8.00 (203)	1.73 (44)	26	11.0 (4.9)
	2500	(420)	10.37 (264)	10.37 (264)	0.50 (13)	2.63 (67)	5.73 (146)	8.00 (203)	1.73 (44)	26	17.5 (7.9)
3/4 (20)	150	(20)	*6.00 (152)	-	0.88 (22)	1.94 (49)	4.40 (112)	6.75 (172)	2.16 (55)	50	10.3 (4.6)
	300	(50)	6.00 (152)	6.50 (165)	0.88 (22)	2.31 (59)	4.40 (112)	6.75 (172)	2.16 (55)	50	10.3 (4.6)
	600	(100)	7.50 (191)	7.50 (191)	0.88 (22)	2.31 (59)	4.40 (112)	6.75 (172)	2.16 (55)	50	13.3 (6.0)
	900/1500	(150/250)	9.00 (229)	9.00 (229)	0.88 (22)	2.56 (65)	4.40 (112)	6.75 (172)	2.16 (55)	50	16.3 (7.3)
	2500	(420)	10.75 (273)	10.75 (273)	0.88 (22)	2.75 (70)	6.20 (158)	8.12 (206)	2.16 (55)	50	22.8 (10.3)
1 1/2 (40)	150	(20)	6.50 (165)	7.00 (178)	1.50 (38)	2.50 (64)	5.62 (143)	11.00 (279)	3.52 (89)	260	21.0 (9.5)
	300	(50)	7.50 (191)	8.00 (203)	1.50 (38)	3.06 (78)	5.62 (143)	11.00 (279)	3.52 (89)	260	29.0 (13.1)
	600	(100)	9.50 (241)	9.50 (241)	1.50 (38)	3.06 (78)	5.62 (143)	11.00 (279)	3.52 (89)	260	32.5 (14.7)
	900/1500	(150/250)	12.00 (305)	12.00 (305)	1.50 (38)	3.50 (89)	5.62 (143)	11.00 (279)	3.52 (89)	260	46.0 (20.8)
	2500	(420)	15.12 (384)	15.25 (387)	1.50 (38)	4.00 (102)	5.62 (143)	11.00 (279)	3.52 (89)	260	74.0 (33.5)
2 (50)	150	(20)	7.00 (178)	7.50 (191)	2.00 (51)	3.00 (76)	6.96 (177)	11.88 (302)	4.83 (123)	480	36.2 (16.4)
	300	(50)	8.50 (216)	9.12 (232)	2.00 (51)	3.25 (83)	6.96 (177)	11.88 (302)	4.83 (123)	480	43.3 (19.6)
	600	(100)	11.50 (292)	11.62 (295)	2.00 (51)	3.25 (83)	6.96 (177)	11.88 (302)	4.83 (123)	480	51.5 (23.3)
	900/1500	(150/250)	14.50 (368)	14.62 (371)	2.00 (51)	4.25 (108)	6.96 (177)	11.88 (302)	4.83 (123)	480	81.0 (36.7)
	2500	(420)	17.75 (451)	17.87 (454)	2.00 (51)	4.62 (118)	6.96 (177)	11.88 (302)	4.83 (123)	480	121.0 (54.8)
3 (80)	150	(20)	8.00 (203)	8.50 (216)	3.00 (76)	3.75 (95)	8.26 (210)	23.89 (607)	5.37 (137)	1300	58.0 (26.3)
	300	(50)	11.12 (282)	11.75 (299)	3.00 (76)	4.12 (105)	8.26 (210)	23.89 (607)	5.37 (137)	1300	77.5 (35.1)

NOTE: " A " dimension to be within ± 0.062 in. (1.5 mm).
* Non-Standard Length.

FORGED STEEL FLOATING BALL VALVES
MODEL T3 REDUCED PORT - FLANGED



DIMENSIONS

SIZE in. (mm)	ASME CLASS	(PN)	A RF	A RTJ	B	C	D	E	F	G	C_v	WEIGHT lb. (kg)
3/4 (20)	150	(20)	4.63 (118)	-	0.50 (13)	0.75 (19)	1.94 (49)	3.29 (83)	4.82 (122)	1.73 (44)	14	5.0 (2.2)
	300	(50)	6.00 (152)	6.50 (165)	0.50 (13)	0.75 (19)	2.31 (59)	3.29 (83)	4.82 (122)	1.73 (44)	14	7.0 (3.1)
	600	(100)	7.50 (191)	7.50 (191)	0.50 (13)	0.75 (19)	2.31 (59)	3.29 (83)	4.82 (122)	1.73 (44)	14	9.0 (4.0)
	900/1500	(150/250)	9.00 (229)	9.00 (229)	0.50 (13)	0.75 (19)	2.56 (65)	5.73 (146)	8.00 (203)	1.73 (44)	14	14.0 (6.3)
	2500	(420)	10.75 (273)	10.75 (273)	0.50 (13)	0.75 (19)	2.75 (70)	5.73 (146)	8.00 (203)	1.73 (44)	14	20.5 (9.2)
1 (25)	150	(20)	5.00 (127)	5.50 (140)	0.88 (22)	1.00 (25)	2.12 (54)	4.40 (112)	6.75 (172)	2.16 (55)	35	8.0 (3.6)
	300	(50)	6.50 (165)	7.00 (178)	0.88 (22)	1.00 (25)	2.44 (62)	4.40 (112)	6.75 (172)	2.16 (55)	35	11.5 (5.2)
	600	(100)	8.50 (216)	8.50 (216)	0.88 (22)	1.00 (25)	2.44 (62)	4.40 (112)	6.75 (172)	2.16 (55)	35	13.8 (6.2)
	900/1500	(150/250)	10.00 (254)	10.00 (254)	0.88 (22)	1.00 (25)	2.94 (75)	4.40 (112)	6.75 (172)	2.16 (55)	35	23.0 (10.4)
	2500	(420)	12.12 (308)	12.12 (308)	0.88 (22)	1.00 (25)	3.13 (79)	6.20 (158)	8.12 (206)	2.16 (55)	35	32.0 (14.5)
2 (50)	150	(20)	7.00 (178)	7.50 (191)	1.50 (38)	2.00 (51)	3.00 (76)	5.62 (143)	11.00 (279)	3.52 (89)	100	27.0 (12.2)
	300	(50)	8.50 (216)	9.12 (232)	1.50 (38)	2.00 (51)	3.25 (83)	5.62 (143)	11.00 (279)	3.52 (89)	100	32.0 (14.5)
	600	(100)	11.50 (292)	11.62 (295)	1.50 (38)	2.00 (51)	3.25 (83)	5.62 (143)	11.00 (279)	3.52 (89)	100	38.0 (17.2)
	900/1500	(150/250)	14.50 (368)	14.62 (371)	1.50 (38)	2.00 (51)	4.25 (108)	5.62 (143)	11.00 (279)	3.52 (89)	100	72.0 (32.6)
	2500	(420)	17.75 (451)	17.87 (454)	1.50 (38)	2.00 (51)	4.62 (118)	5.62 (143)	11.00 (279)	3.52 (89)	100	107.5 (48.7)
3 (80)	150	(20)	8.00 (203)	8.50 (216)	2.00 (51)	3.00 (76)	3.75 (95)	6.96 (177)	11.88 (302)	4.83 (123)	420	50.0 (22.6)
	300	(50)	11.12 (282)	11.75 (299)	2.00 (51)	3.00 (76)	4.12 (105)	6.96 (177)	11.88 (302)	4.83 (123)	420	63.2 (28.6)
	600	(100)	14.00 (356)	14.12 (359)	2.00 (51)	3.00 (76)	4.12 (105)	6.96 (177)	11.88 (302)	4.83 (123)	420	76.0 (34.4)
	900	(150)	15.00 (381)	15.12 (384)	2.00 (51)	3.00 (76)	4.75 (121)	6.96 (177)	11.88 (302)	4.83 (123)	420	97.0 (43.9)
	1500	(250)	18.50 (470)	18.62 (473)	2.00 (51)	3.00 (76)	5.25 (133)	6.96 (177)	11.88 (302)	4.83 (123)	420	134.0 (60.7)
	2500	(420)	22.75 (578)	23.00 (584)	2.00 (51)	3.00 (76)	6.00 (152)	7.77 (197)	23.89 (607)	4.83 (123)	420	223.0 (101.1)
4 (100)	150	(20)	9.00 (229)	9.50 (241)	3.00 (76)	4.00 (102)	4.50 (114)	8.26 (210)	23.89 (607)	5.37 (137)	770	72.5 (32.8)
	300	(50)	12.00 (305)	12.63 (321)	3.00 (76)	4.00 (102)	5.00 (127)	8.26 (210)	23.89 (607)	5.37 (137)	770	99.0 (44.9)

NOTE: " A " dimension to be within ± 0.062 in. (1.5 mm).

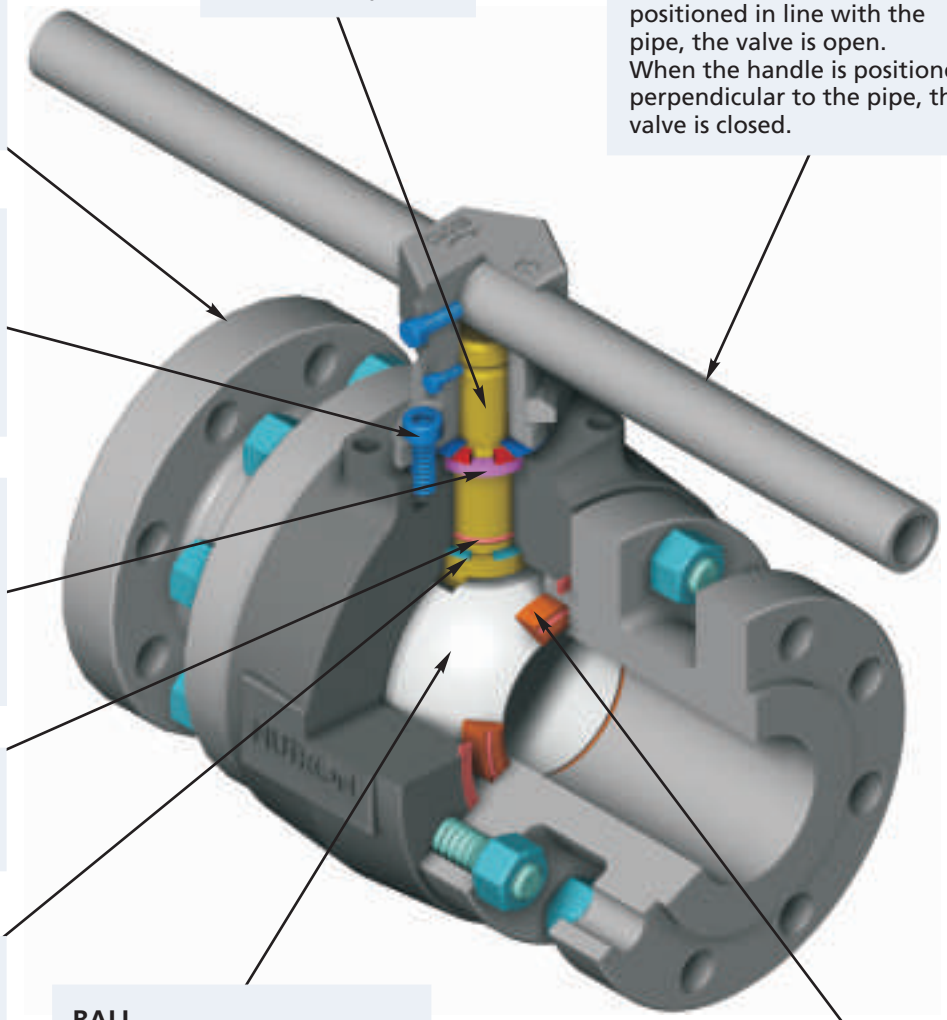
FORGED STEEL FLOATING BALL VALVES
STANDARD FEATURES

MODEL B3

BODY CONSTRUCTION
Forged steel bolted construction.
A machined pad area is drilled and tapped for actuation as a standard.
Bolted construction allows for combinations of end connections.

STEM
Blowout proof stem is back-seated through the valve body.

HANDLE
Rugged adjustable pipe handle. Handle position indicates flow position. When the handle is positioned in line with the pipe, the valve is open.
When the handle is positioned perpendicular to the pipe, the valve is closed.



CAP SCREWS
Dual purpose;
allows for easy stem packing adjustment without handle removal while providing a stop for the handle.

PACKING
Self adjusting by means of a Belleville washer. Allows for long service life before manual packing adjustment is necessary.

STEM SEAL
O-Ring installed on stem shaft.

THRUST WASHER
Acts as a bearing between the body and stem.

BALL
The floating ball design allows for positive shut off in either flow direction.
Includes pressure equalization hole to prevent trapping of pressure in the body cavity.

SEATS
Materials available are Teflon, Delrin, PEEK and Devlon.

FORGED STEEL FLOATING BALL VALVES
MODEL B3 SIZES AVAILABLE

ASME CLASS (PN)		150 (20)	300 (50)	600 (100)	900 (150)	1500 (250)
Full Port	in. (mm)	2 thru 4 (50 thru 100)	2 thru 4 (50 thru 100)	1 1/2 thru 3 (40 thru 80)	1 1/2 thru 3 (40 thru 80)	1 1/2 thru 3 (40 thru 80)
Reduced Port		3 thru 6 (80 thru 150)	3 thru 6 (80 thru 150)	2 thru 4 (50 thru 100)	2 thru 4 (50 thru 100)	2 thru 4 (50 thru 100)
WOG (psi)				**2000**		**4000**
Full Port	in. (mm)			3 (80)		3 (80)
Reduced Port				4 (100)		

ORDERING INFORMATION

How to develop typical figure numbers without options:

MODEL
B3 - 3 PIECE BOLTED

BORE
F - FULL PORT
R - REDUCED PORT

SIZE in. (mm)
15 - 1 1/2 (40)
20 - 2 (50)
30 - 3 (80)
40 - 4 (100)
60 - 6 (150)

***STYLE**
A - STAINLESS STEEL -50°F (-46°C)
B - STANDARD
D - FULL STAINLESS STEEL -150°F (-100°C)
G - STEAM HIGH TEMP/SOUR +600°F (+315°C)
H - HIGH TEMP/SOUR +500°F (+260°C)
L - SOUR LOW TEMP -50°F (-46°C)
N - MONEL STEEL -150°F (-100°C)
Q - DUPLEX STEEL -60°F (-51°C)
S - SOUR -20°F (-29°C)

FIRE SAFE

B3 - F 30 R 06 L Z

END CONNECTION
A - RF SMOOTH FACE
B - BW SCH 40
C - BW SCH 80
D - BW SCH 160
E - BW SCH XXH
J - RTJ
R - RAISED FACE
S - FEMALE NPT
W - SOCKET WELD

PRESSURE
20 - 2000 WOG
40 - 4000 WOG
01 - 150 ASME (PN 20)
03 - 300 ASME (PN 50)
06 - 600 ASME (PN 100)
09 - 900 ASME (PN 150)
15 - 1500 ASME (PN 250)

***COMMON OPTIONS**
ANTI-STATIC SPRING
BLEEDER HOLE
BLEEDER VALVE
CARR. SEAL CLOSE
CARR. SEAL OPEN
DELRIN SEATS
DEVLON SEATS
ELECTROLESS NICKEL PLATING (ENP)
EXTENDED STEM
GEAR OPERATOR
GRAPHITE PACKING
HSN O-RINGS
IMPREGLON COATING
LOCKING HANDLE
NITRILE O-RINGS
PEEK SEATS
SEAL INJECTION
TEFLON O-RINGS
VITON O-RINGS

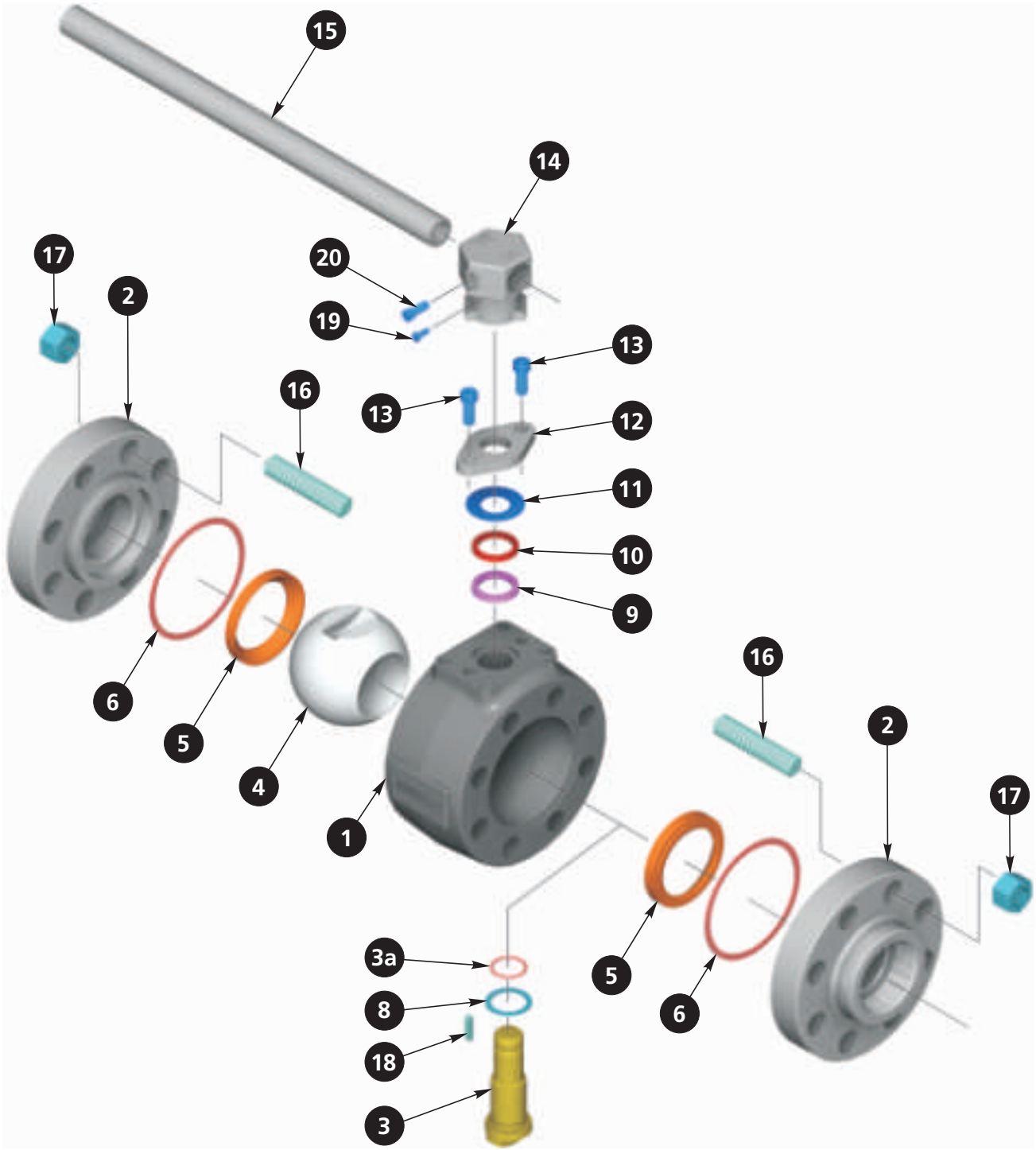
Examples:

B3-F30R06LZ = Model B3, Full Port, 3 in. (80 mm), Raised Face Flanges, 600 ASME (PN 100), Sour Low Temp Valve, Fire Safe.

* Consult Cameron, Valves & Measurement Sales Department for detailed valve style descriptions, full range of options, materials, actuation packages or for a particular special valve service application.

Cameron reserves the right to substitute materials listed on the following pages with alternate materials for the designated service.

FORGED STEEL FLOATING BALL VALVES
MODEL B3 THREADED END CONNECTIONS



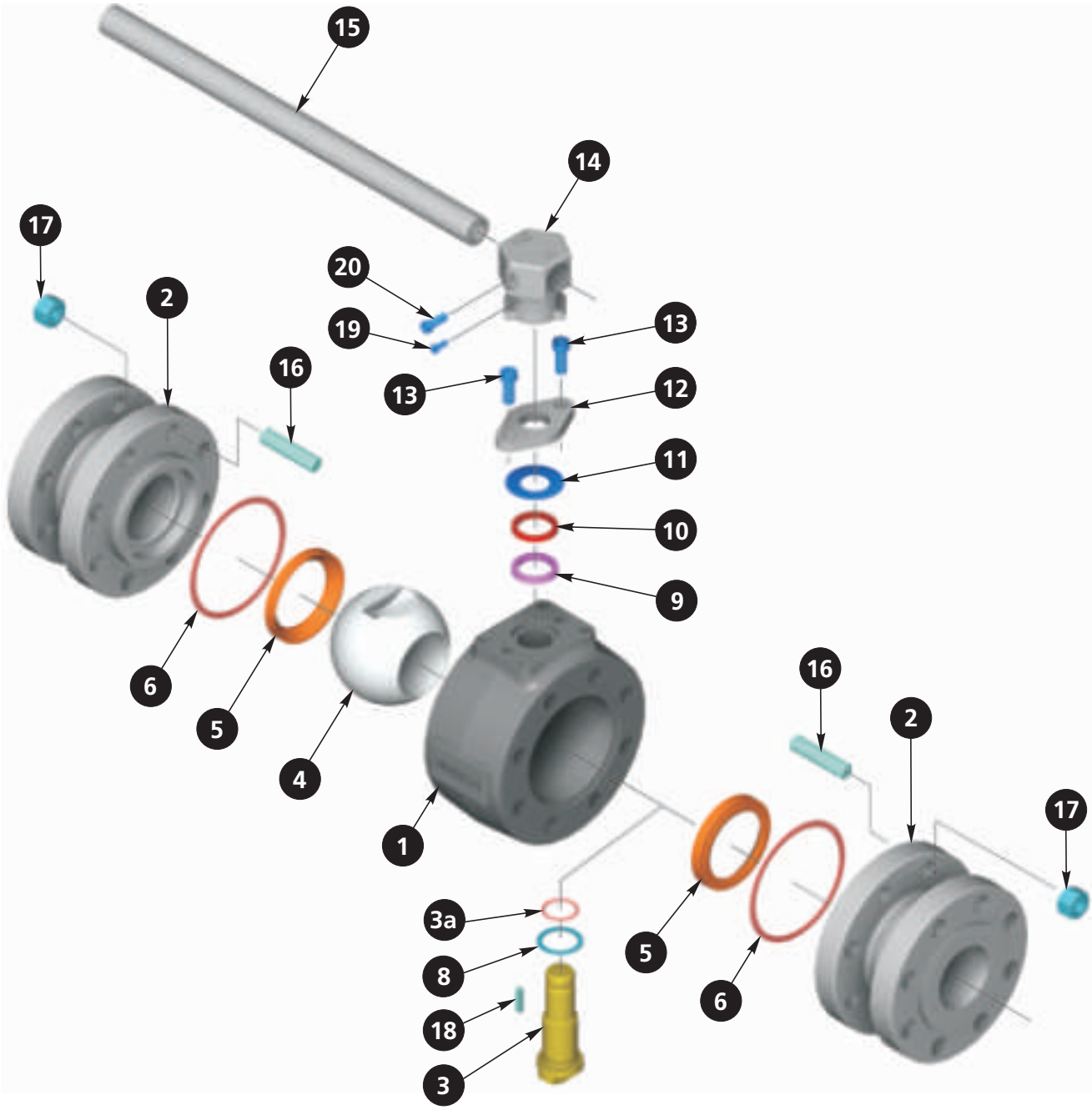
FORGED STEEL FLOATING BALL VALVES
MODEL B3 MATERIALS LIST - THREADED END CONNECTIONS

ITEM	PART	WORKING PRESSURE	STANDARD -20°F (-29°C)	SOUR -20°F (-29°C)
1	Body	All	ASTM A105	ASTM A105
2	End Caps	All	ASTM A350 LF2	ASTM A350 LF2
■ 3	Stem	All	ASTM A322 Gr. 4130, Plated	ASTM A564 17-4PH
■• 3a	Stem O-Ring	All	HSN	HSN
■ 4	Ball	All	Carbon Steel, Chrome Plated	ASTM A351 Gr. CF8M
■• 5	Seats	2000 4000	Teflon Delrin	Teflon Delrin
■• 6	Body Seals	All	Spiral Wound Gasket	Spiral Wound Gasket
■• 8	Thrust Washer	2000 4000	Teflon Delrin	Teflon Delrin
■• 9	Packing	2000/4000	Graphite/Teflon	Graphite/Teflon
10	Packing Follower	All	Carbon Steel, Plated	Stainless Steel
11	Belleville Washer	All	Carbon Steel	Stainless Steel
12	Gland Flange	All	Carbon Steel, Plated	Carbon Steel, Plated
13	Cap Screws	All	Carbon Steel	Stainless Steel
14	Handle Nut	All	Carbon Steel	Carbon Steel
15	Pipe	All	Carbon Steel	Carbon Steel
16	Studs	All	ASTM A193 B7	ASTM A193 B7M
17	Nuts	All	ASTM A194 2H	ASTM A194 2HM
18	Key	All	Carbon Steel	Carbon Steel
19	Screw	All	Carbon Steel, Plated	Carbon Steel, Plated
20	Screw	All	Carbon Steel, Plated	Carbon Steel, Plated

ITEM	PART	WORKING PRESSURE	SOUR & LOW TEMP -50°F (-46°C)	STAINLESS STEEL -50°F (-46°C)
1	Body	All	ASTM A350 LF2	ASTM A479 TYPE 316
2	End Caps	All	ASTM A350 LF2	ASTM A479 TYPE 316
■ 3	Stem	All	ASTM A564 17-4PH	ASTM A564 17-4PH with Nitriding
■• 3a	Stem O-Ring	All	HSN	HSN
■ 4	Ball	All	ASTM A351 Gr. CF8M	ASTM A351 Gr. CF8M
■• 5	Seats	2000 4000	Teflon Delrin	Teflon PEEK
■• 6	Body Seals	All	Spiral Wound Gasket	Spiral Wound Gasket
■• 8	Thrust Washer	2000 4000	Teflon Delrin	Teflon PEEK
■• 9	Packing	2000/4000	Graphite/Teflon	Graphite/Teflon
10	Packing Follower	All	Stainless Steel	Stainless Steel
11	Belleville Washer	All	Stainless Steel	Stainless Steel
12	Gland Flange	All	Carbon Steel, Plated	Carbon Steel, Plated
13	Cap Screws	All	Stainless Steel	Stainless Steel
14	Handle Nut	All	Carbon Steel	Carbon Steel
15	Pipe	All	Carbon Steel	Carbon Steel
16	Studs	All	ASTM A320 L7M	ASTM A320 L7M, Coated
17	Nuts	All	ASTM A194 L7M	ASTM A194 L7M, Coated
18	Key	All	Carbon Steel	Carbon Steel
19	Screw	All	Carbon Steel, Plated	Carbon Steel, Plated
20	Screw	All	Carbon Steel, Plated	Carbon Steel, Plated

■ Major repair kit.
• Minor repair kit.

FORGED STEEL FLOATING BALL VALVES
MODEL B3 FLANGED END CONNECTIONS
3 in. (80 mm) FULL PORT & 4 in. (100 mm) REDUCED PORT
ASME CLASS 600, 900 & 1500 (PN 100, 150 & 250)



FORGED STEEL FLOATING BALL VALVES
MODEL B3 MATERIALS LIST - FLANGED END CONNECTIONS

3 in. (80 mm) FULL PORT & 4 in. (100 mm) REDUCED PORT, ASME CLASS 600, 900 & 1500 (PN 100, 150 & 250)

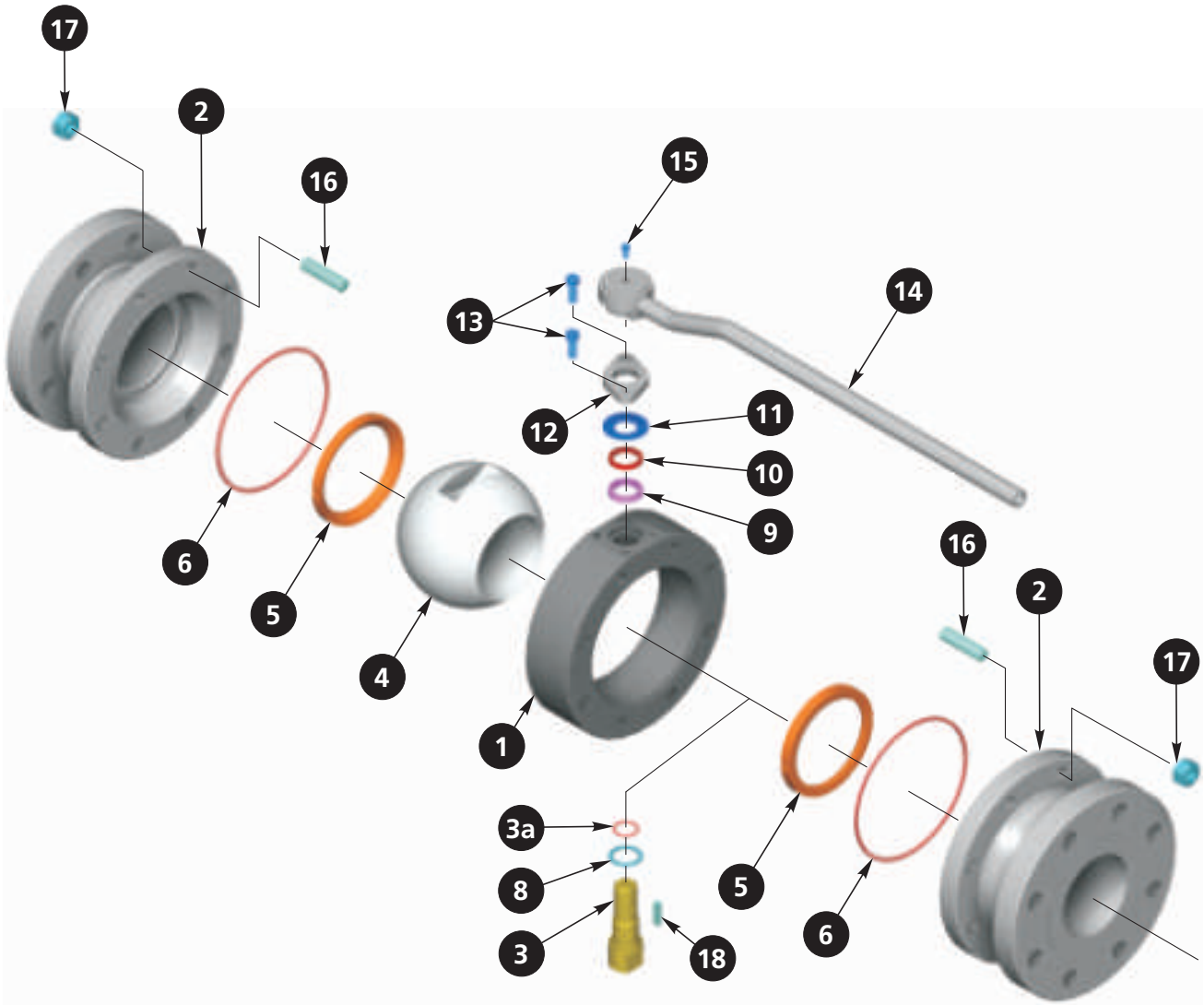
ITEM	PART	ASME CLASS	STANDARD -20°F (-29°C)	SOUR -20°F (-29°C)
1	Body	All	ASTM A105	ASTM A105
2	End Caps	600, 900 & 1500	ASTM A105	ASTM A105
■ 3 ■• 3a	Stem Stem O-Ring	All All	ASTM A322 Gr. 4130, Plated HSN	ASTM A564 17-4PH HSN
■ 4	Ball	All	ASTM A675 CHR. PL.	ASTM A351 Gr. CF8M
■• 5	Seats	600 900 & 1500	Teflon Delrin	Teflon Delrin
■• 6	Body Seals	All	Spiral Wound Gasket	Spiral Wound Gasket
■• 8	Thrust Washer	600 900 & 1500	Teflon Delrin	Teflon Delrin
■• 9	Packing	All	Graphite	Graphite
10	Packing Follower	All	Carbon Steel, Plated	Stainless Steel
11	Belleville Washer	All	Carbon Steel	Stainless Steel
12	Gland Flange	All	Carbon Steel, Plated	Carbon Steel, Plated
13	Cap Screws	All	Carbon Steel	Stainless Steel
14	Handle Nut	All	Carbon Steel	Carbon Steel
15	Pipe	All	Carbon Steel	Carbon Steel
16	Studs	All	ASTM A193 B7	ASTM A193 B7M
17	Nuts	All	ASTM A194 2H	ASTM A194 2HM
18	Key	All	Carbon Steel	Carbon Steel
19	Screw	All	Carbon Steel, Plated	Carbon Steel, Plated
20	Screw	All	Carbon Steel, Plated	Carbon Steel, Plated

ITEM	PART	ASME CLASS	SOUR & LOW TEMP -50°F (-46°C)	STAINLESS STEEL -50°F (-46°C)
1	Body	All	ASTM A350 LF2	ASTM A479 TYPE 316
2	End Caps	All	ASTM A350 LF2	ASTM A479 TYPE 316
■ 3 ■• 3a	Stem Stem O-Ring	All All	ASTM A564 17-4PH HSN	ASTM A564 17-4PH with Nitriding HSN
■ 4	Ball	All	ASTM A351 Gr. CF8M	ASTM A351 Gr. CF8M
■• 5	Seats	600 900 & 1500	Teflon Delrin	Teflon PEEK
■• 6	Body Seals	All	Spiral Wound Gasket	Spiral Wound Gasket
■• 8	Thrust Washer	600 900 & 1500	Teflon Delrin	Teflon PEEK
■• 9	Packing	All	Graphite	Graphite
10	Packing Follower	All	Stainless Steel	Stainless Steel
11	Belleville Washer	All	Stainless Steel	Stainless Steel
12	Gland Flange	All	Carbon Steel, Plated	Carbon Steel, Plated
13	Cap Screws	All	Stainless Steel	Stainless Steel
14	Handle Nut	All	Carbon Steel	Carbon Steel
15	Pipe	All	Carbon Steel	Carbon Steel
16	Studs	All	ASTM A320 L7M	ASTM A320 L7M, Coated
17	Nuts	All	ASTM A194 L7M	ASTM A194 L7M, Coated
18	Key	All	Carbon Steel	Carbon Steel
19	Screw	All	Carbon Steel, Plated	Carbon Steel, Plated
20	Screw	All	Carbon Steel, Plated	Carbon Steel, Plated

■ Major repair kit.
• Minor repair kit.

Note: Fire safe trim offered as standard whenever possible.
Consult Cameron, Valves & Measurement Sales Department for fire safe trim.

FORGED STEEL FLOATING BALL VALVES
MODEL B3 - 4 in. (100 mm) FULL PORT / 6 in. (150 mm) REDUCED PORT
ASME CLASS 150 & 300 (PN 20 & 50)



FORGED STEEL FLOATING BALL VALVES
MODEL B3 MATERIALS LIST

4 in. (100 mm) FULL PORT & 6 in. (150 mm) REDUCED PORT
ASME CLASS 150 & 300 (PN 20 & 50)

	ITEM	PART	SOUR -20°F (-29°C)	SOUR & LOW TEMP -20°F (-29°C)
	1	Body	ASTM A105	ASTM A350 LF2
	2	End Caps	ASTM A350 LF2	ASTM A350 LF2
■	3	Stem	ASTM A564 17-4PH	ASTM A564 17-4PH
■•	3a	Stem O-Ring	HSN	HSN
■	4	Ball	ASTM A351 Gr. CF8M	ASTM A351 Gr. CF8M
■•	5	Seats	Teflon	Teflon
■•	6	Body O-Rings	Viton	Viton
■•	8	Thrust Washer	Teflon	Teflon
■•	9	Packing	Graphite	Graphite
	10	Packing Follower	Stainless Steel	Stainless Steel
	11	Belleville Washer	Stainless Steel	Stainless Steel
	12	Gland Flange	Carbon Steel, Plated	Carbon Steel, Plated
	13	Cap Screws	Stainless Steel	Stainless Steel
	14	Handle	Carbon Steel	Carbon Steel
	15	Cap Screw, Hex Head	Carbon Steel	Carbon Steel
	16	Studs	ASTM A193 B7M	ASTM A320 L7M
	17	Nuts	ASTM A194 2HM	ASTM A194 L7M
	18	Key	Carbon Steel	Carbon Steel

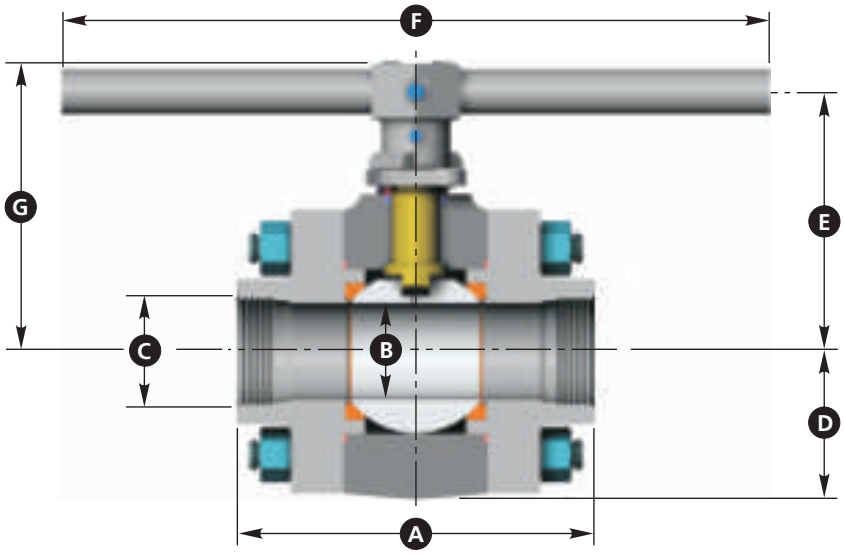
	ITEM	PART	STAINLESS STEEL -50°F (-46°C)
	1	Body	ASTM A479 TYPE 316
	2	End Caps	ASTM A479 TYPE 316
■	3	Stem	ASTM A564 17-4PH with Nitriding
■•	3a	Stem O-Ring	HSN
■	4	Ball	ASTM A351 Gr. CF8M
■•	5	Seats	Teflon
■•	6	Body O-Rings	Teflon
■•	8	Thrust Washer	Teflon
■•	9	Packing	Graphite
	10	Packing Follower	Stainless Steel
	11	Belleville Washer	Stainless Steel
	12	Gland Flange	Carbon Steel, Plated
	13	Cap Screws	Stainless Steel
	14	Handle	Carbon Steel
	15	Cap Screw, Hex Head	Carbon Steel
	16	Studs	ASTM A320 L7M, Coated
	17	Nuts	ASTM A194 L7M, Coated
	18	Key	Carbon Steel

■ Major repair kit.
• Minor repair kit.

FORGED STEEL FLOATING BALL VALVES

MODEL B3 THREADED

FULL PORT
3 in. (80 mm)
REDUCED PORT
4 in. (100 mm)



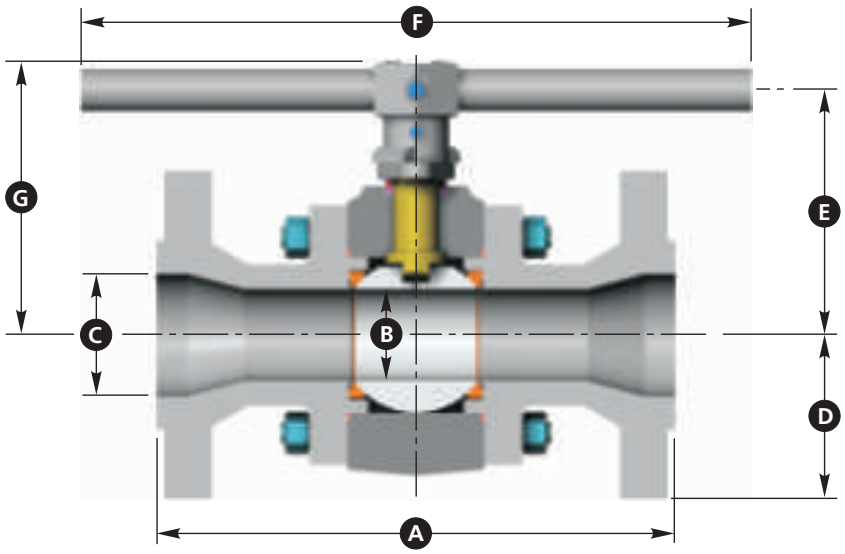
DIMENSIONS

SIZE in. (mm)	WOG	A	B	C	D	E	F	G	C_v	WEIGHT lb. (kg)
3 FP (80 FP)	2000	10.0 (254)	3.0 (76)	3.0 (76)	4.45 (113)	8.00 (203)	22.0 (559)	8.90 (226)	1300	131.0 (59.4)
	4000	10.0 (254)	3.0 (76)	3.0 (76)	4.45 (113)	8.00 (203)	22.0 (559)	8.90 (226)	1300	131.0 (59.4)
4 RP (100 RP)	2000	12.0 (305)	3.0 (76)	4.0 (102)	4.45 (113)	8.00 (203)	22.0 (559)	8.90 (226)	770	145.0 (65.7)

NOTE: " A " dimension to be within ± 0.062 in. (1.5 mm).

MODEL B3 FLANGED

FULL PORT
3 in. (80 mm)
REDUCED PORT
4 in. (100 mm)



DIMENSIONS

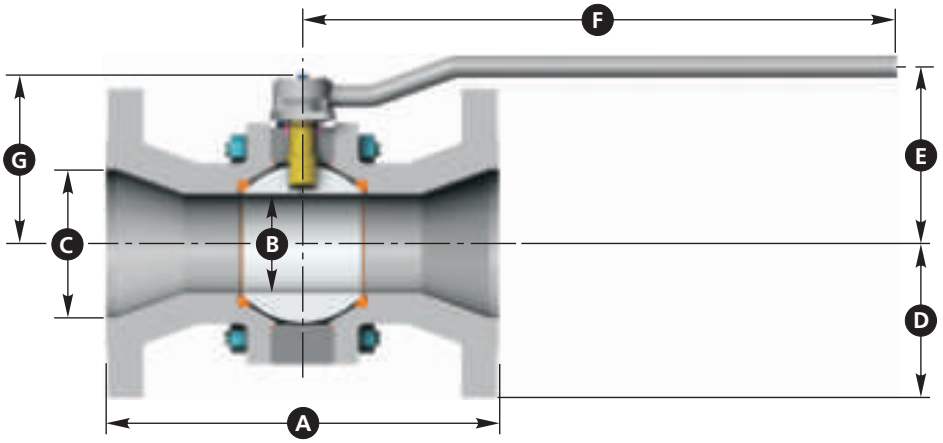
SIZE in. (mm)	ASME CLASS	(PN)	A RF	A RTJ	B	C	D	E	F	G	C_v	WEIGHT lb. (kg)
3 FP (80 FP)	600	(100)	14.0 (356)	14.12 (359)	3.0 (76)	3.0 (76)	4.12 (105)	8.00 (203)	22.0 (559)	8.90 (226)	1300	161.0 (73.0)
	900	(150)	15.0 (381)	15.12 (384)	3.0 (76)	3.0 (76)	4.75 (121)	8.00 (203)	22.0 (559)	8.90 (226)	1300	191.0 (86.6)
	1500	(250)	18.5 (470)	18.62 (473)	3.0 (76)	3.0 (76)	5.25 (133)	8.00 (203)	22.0 (559)	8.90 (226)	1300	239.0 (108.4)
4 RP (100 RP)	600	(100)	17.0 (432)	17.12 (435)	3.0 (76)	4.0 (102)	5.37 (136)	8.00 (203)	22.0 (559)	8.90 (226)	770	211.0 (95.7)
	900	(150)	18.0 (457)	18.12 (460)	3.0 (76)	4.0 (102)	5.75 (146)	8.00 (203)	22.0 (559)	8.90 (226)	770	242.0 (109.7)
	1500	(250)	21.5 (546)	21.62 (549)	3.0 (76)	4.0 (102)	6.12 (155)	8.00 (203)	22.0 (559)	8.90 (226)	770	292.0 (132.4)

NOTE: " A " dimension to be within ± 0.062 in. (1.5 mm).

FORGED STEEL FLOATING BALL VALVES

MODEL B3 FLANGED

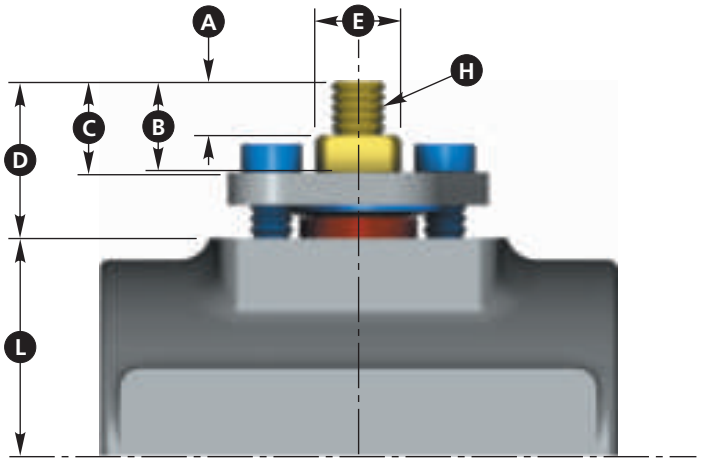
FULL PORT
4 in. (100 mm)
REDUCED PORT
6 in. (150 mm)

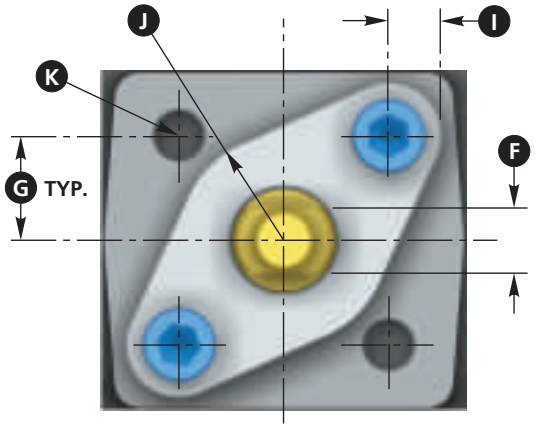


DIMENSIONS

SIZE in. (mm)	ASME CLASS	(PN)	A	B	C	D	E	F	G	C_v	WEIGHT lb. (kg)
4 FP (100 FP)	150	(20)	9.00 (229)	4.00 (102)	4.00 (102)	4.50 (114)	7.60 (193)	24.00 (610)	6.65 (169)	2300	101 (45.8)
	300	(50)	12.00 (305)	4.00 (102)	4.00 (102)	5.00 (127)	7.60 (193)	24.00 (610)	6.65 (169)	2300	143 (64.8)
6 RP (150 RP)	150	(20)	10.50 (267)	4.00 (102)	6.00 (152)	5.50 (140)	7.60 (193)	24.00 (610)	6.65 (169)	1800	128 (58.0)
	300	(50)	15.88 (403)	4.00 (102)	6.00 (152)	6.25 (160)	7.60 (193)	24.00 (610)	6.65 (169)	1800	143 (64.8)

MODEL T3 ACTUATOR MOUNTING DIMENSIONS





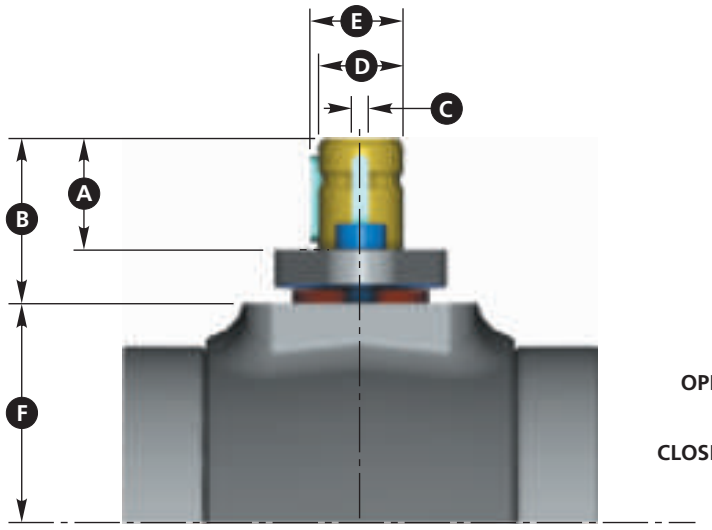
DIMENSIONS

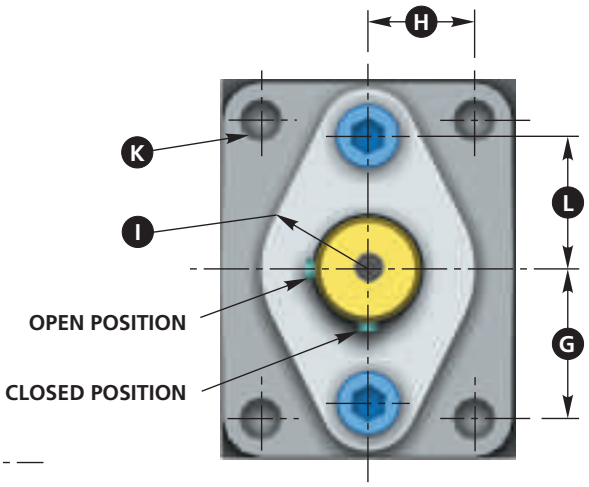
SIZE in. (mm)	A	B	C	D	E	F	G	H	I	J	K	L
1/4 FP (8 FP)	0.300 (7.6)	0.440 (11.1)	0.500 (12.7)	0.725 (18.4)	0.464 (11.8)	0.253 (6.4)	0.468 (11.9)	0.250-20 UNC (6.35-20 UNC)	0.23 (5.8)	0.50 (12.7)	#10-32 UNF-2B x 0.31 DP. (#10-32 UNF-2B x 7.9 DP.)	1.002 (25.5)
3/8 FP (10 FP)	0.300 (7.6)	0.440 (11.1)	0.500 (12.7)	0.725 (18.4)	0.464 (11.8)	0.253 (6.4)	0.468 (11.9)	0.250-20 UNC (6.35-20 UNC)	0.23 (5.8)	0.50 (12.7)	#10-32 UNF-2B x 0.31 DP. (#10-32 UNF-2B x 7.9 DP.)	1.002 (25.5)
1/2 FP / 3/4 RP (15 FP / 20 RP)	0.300 (7.6)	0.440 (11.1)	0.500 (12.7)	0.725 (18.4)	0.464 (11.8)	0.253 (6.4)	0.468 (11.9)	0.250-20 UNC (6.35-20 UNC)	0.23 (5.8)	0.50 (12.7)	#10-32 UNF-2B x 0.31 DP. (#10-32 UNF-2B x 7.9 DP.)	1.002 (25.5)
3/4 FP / 1 RP (20 FP / 25 RP)	0.312 (7.9)	0.515 (13.1)	0.560 (14.2)	0.905 (23.0)	0.496 (12.6)	0.314 (7.9)	0.498 (12.6)	0.312-18 UNC (7.92-18 UNC)	0.25 (6.4)	0.50 (12.7)	0.25-28 UNF-2B x 0.30 DP. (6.35-28 UNF-2B x 7.6 DP.)	1.250 (31.8)
*1 1/2 FP / 2 RP (*40 FP / 50 RP)	0.475 (12.1)	0.826 (21.0)	0.900 (22.9)	1.270 (32.3)	0.749 (19.0)	0.441 (11.2)	0.737 (18.7)	0.438-14 UNC (11.1-14 UNC)	0.40 (10.2)	0.75 (19.1)	0.312-24 UNF-2B x 0.437 DP. (7.92-24 UNF-2B x 11.1 DP.)	2.250 (57.2)
2 FP / 3 RP (50 FP / 80 RP)	0.690 (17.5)	1.180 (30.0)	1.225 (31.1)	1.821 (46.3)	1.000 (25.4)	0.628 (16.0)	0.875 (22.2)	0.625-11 UNC (15.9-11 UNC)	0.41 (10.4)	1.00 (25.4)	0.375-24 UNF-2B x 0.50 DP. (9.53-24 UNF-2B x 12.7 DP.)	3.000 (76.2)
3 FP / 4 RP (80 FP / 100 RP)	0.690 (17.5)	1.180 (30.0)	1.225 (31.1)	1.821 (46.3)	1.000 (25.4)	0.628 (16.0)	0.875 (22.2)	0.625-11 UNC (15.9-11 UNC)	0.41 (10.4)	1.00 (25.4)	0.375-24 UNF-2B x 0.50 DP. (9.53-24 UNF-2B x 12.7 DP.)	3.500 (88.9)

* Applies to B3 1 1/2 in. (40 mm) full port & 2 in. (50 mm) reduced port ASME Class 600, 900 & 1500 valves & 2 in. (50 mm) full port & 3 in. (80 mm) reduced port ASME Class 150 & 300 valves.
** Applies to B3 2 in. (50 mm) full port & 3 in. (80 mm) reduced port ASME Class 600, 900 & 1500 valves.
*** Applies to B3 3 in. (80 mm) full port & 4 in. (100 mm) reduced port ASME Class 150 & 300 valves.

FORGED STEEL FLOATING BALL VALVES
MODEL B3 ACTUATOR MOUNTING DIMENSIONS*

3 in. (80 mm) FULL PORT
4 in. (100 mm) REDUCED PORT

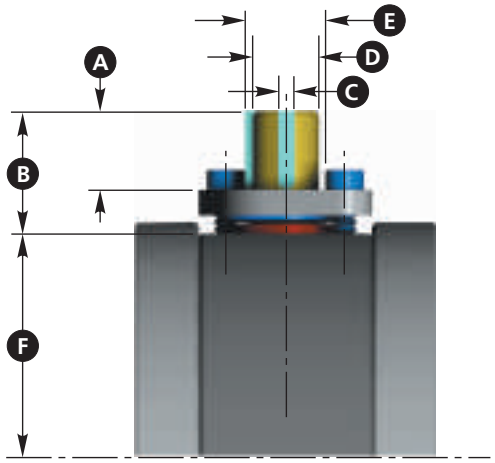


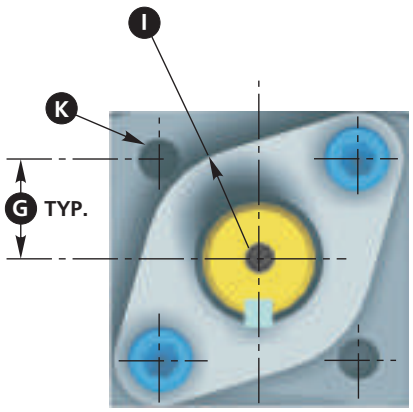


DIMENSIONS

SIZE in. (mm)	A	B	C	D	E	F	G	H	I	K	L
3 FP / 4 RP	1.64	2.395	0.25	1.248	1.362	4.875	1.75	1.25	1.25R	0.5-13UNC-2B x 0.62 DP.	1.566
(80 FP / 100 RP)	(41.7)	(60.8)	(6.4)	(31.7)	(34.6)	(123.8)	(44.4)	(31.8)	(31.8R)	(12.7-13UNC-2B x 15.7 DP.)	(39.8)
(ASME 600-1500, WOG 2000-4000)											

4 in. (100 mm) FULL PORT
6 in. (150 mm) REDUCED PORT



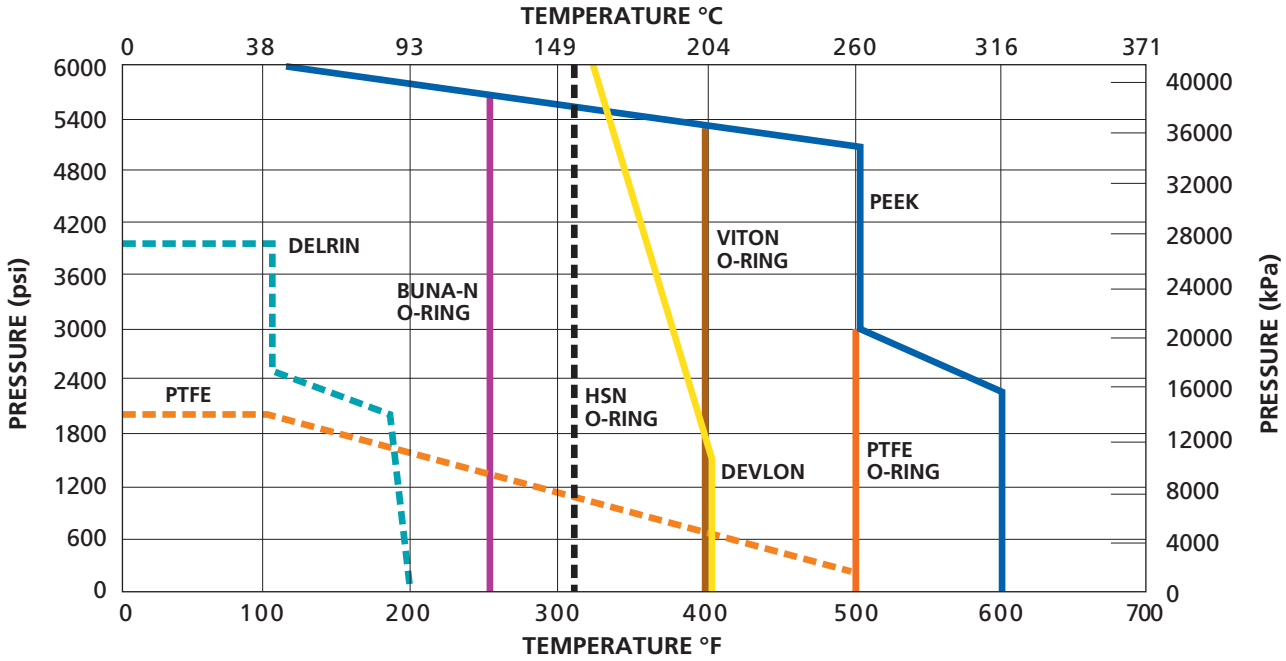


DIMENSIONS

SIZE in. (mm)	A	B	C	D	E	F	G	K	I
4 FP / 6 RP	1.255	1.85	0.25	1.00	1.11	4.688	0.877	0.375-24UNF-2B x 0.5 DEEP	1.00
(100 FP / 150 RP)	(31.9)	(47.0)	(6.4)	(25.4)	(28.2)	(119.1)	(22.3)	(9.5-24UNF-2B x 12.7 DEEP)	(25.4)
(ASME 150 / 300)									

* For B3 1 1/2 in., 2 in., 3 in. & 4 in. (40 mm, 50 mm, 80 mm & 100 mm) valves, see footnote on page 25.

FORGED STEEL FLOATING BALL VALVES
MODEL T3 & B3 PRESSURE/TEMPERATURE RATINGS (SEATS AND SEALS)*



* Consult ASME B16.34 for Body and Adapter Material Pressure/Temperature Ratings.

MODEL T3 & B3 BREAKAWAY TORQUE DATA

Torque=inch-pounds

Bore Size in.	(DN)	ASME CLASS (PN) Pressure (psi) Seat Material	0	150 (20) 285	300 (50) 740	1000	600 (100) 1480	2000	900 (150) 2220	3000	1500 (250) 3705	4000	5000	2500 (420) 6000
1/2	(15)	Peek	72	84	96	108	120	132	144	156	180	192	216	240
		Devlon	72	84	96	108	120	132	144	156	180	192	216	240
		Delrin	60	72	84	96	108	120	132	144	168	180	-	-
		Teflon	60	72	84	96	108	120	-	-	-	-	-	-
7/8	(22)	Peek	276	276	276	276	276	300	324	360	420	444	540	660
		Devlon	96	108	120	132	144	156	168	180	192	204	240	300
		Delrin	96	108	120	132	144	156	168	180	192	204	-	-
		Teflon	96	108	120	132	144	156	-	-	-	-	-	-
1 1/2	(40)	Peek	600	648	696	744	792	840	864	936	1020	1080	1200	1500
		Devlon	360	420	480	576	660	720	792	900	960	1020	1080	1260
		Delrin	336	396	480	576	660	720	792	900	960	1020	-	-
		Teflon	336	360	396	420	456	504	-	-	-	-	-	-
2	(50)	Peek	840	1080	1440	1680	1920	2100	2280	2700	3120	3300	3600	4200
		Devlon	600	720	900	1080	1200	1500	1680	1920	2160	2400	2400	2880
		Delrin	600	720	900	1080	1320	1560	1740	2040	2280	2520	-	-
		Teflon	600	636	816	936	1128	1344	-	-	-	-	-	-
3	(80)	Peek	960	1440	2760	3840	4800	5760	6480	7200	8400	9000	-	-
		Devlon	720	1200	1920	2400	2880	3360	3600	4080	4800	5760	-	-
		Delrin	840	1380	2280	2640	3000	3600	3900	4200	4800	5760	-	-
		Teflon	720	1320	1920	2400	2880	3600	-	-	-	-	-	-
4	(100)	Peek	1440	2400	3840	-	-	-	-	-	-	-	-	-
		Devlon	1200	2040	3120	-	-	-	-	-	-	-	-	-
		Teflon	1080	1944	2820	-	-	-	-	-	-	-	-	-

Torque values shown are to be used as a guide for actuator selection. All above torque values are based upon clean liquid service.
Additional factors such as media characteristics, number of cycles and temperature may require an additional safety factor.
Please contact the actuator supplier/manufacturer for these factors.

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Inconel	INCO Nickel Sales, Inc.
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Viton	E.I. DuPont De Nemours & Company

CAMERON
VALVES & MEASUREMENT
3250 Briarpark Drive, Suite 300
Houston, Texas 77042
USA Toll Free 800 323 9160

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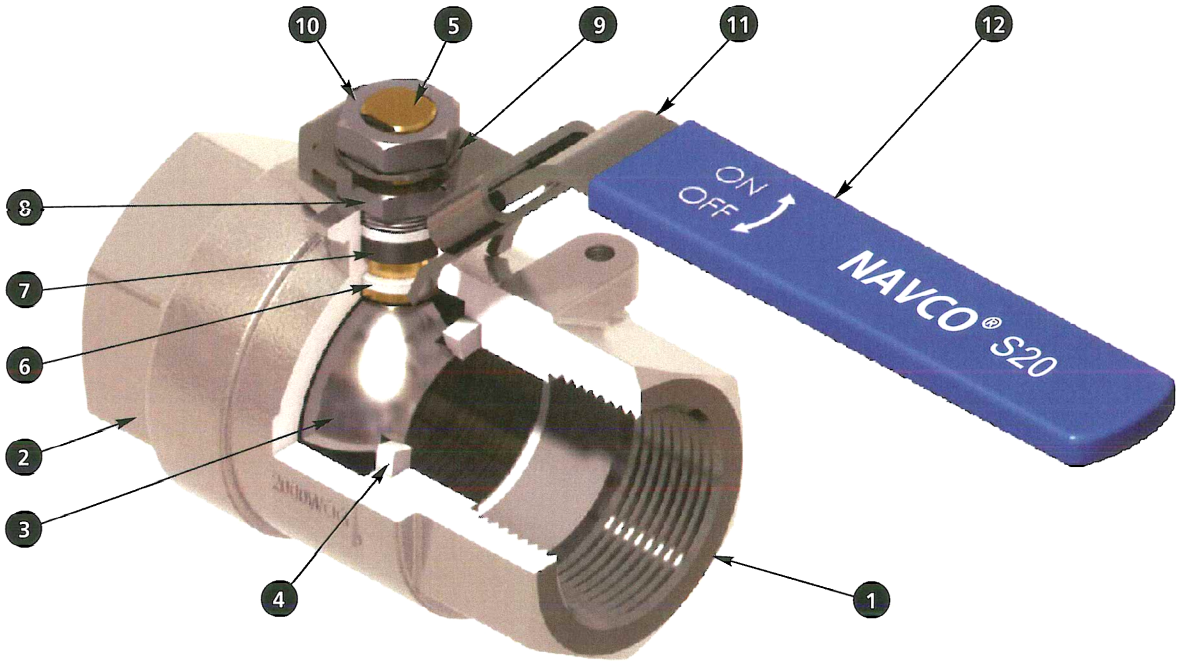
NAVCO® S20 BALL VALVE



FEATURES AND BENEFITS

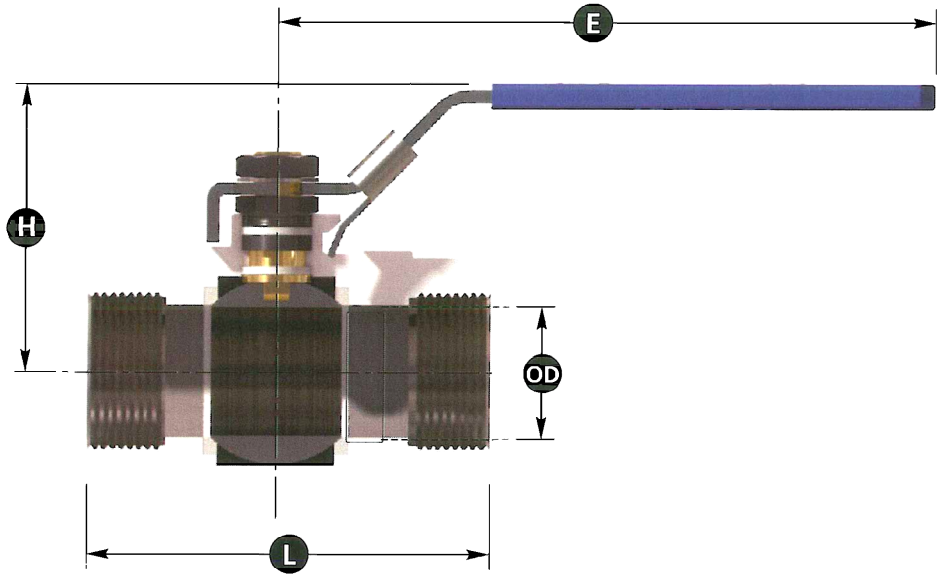
- 2-PC THREADED END BALL VALVE, FULL PORT, 2000 WOG
- SEAL WELDED IN FULL STAINLESS VERSION
- INVESTMENT CAST BODY
- FIRE TESTED & CERTIFIED API 607 5TH EDITION
- WORKING PRESSURE: 2000 PSI
- CONFORMS TO NACE MR0175 (2002) SPECIFICATION
- POSITIVELY RETAINED STEM DESIGN
- HANDLE LOCKING DEVICE

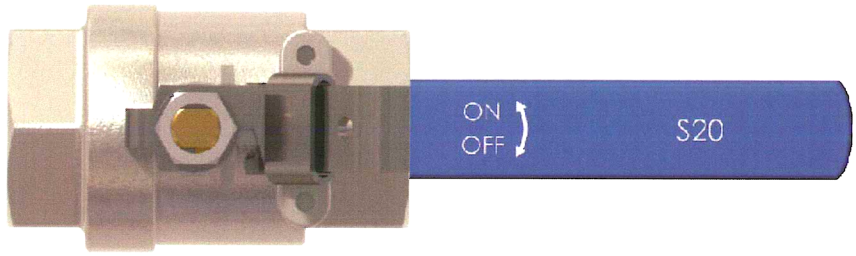
MATERIALS LIST

ITEM	QTY.	PART	MATERIAL
1	1	Body	WCB or CF8M
2	1	Cap	WCB or CF8M
3	1	Ball	AISI 316
4	2	Seat	RPTFE
5	1	Stem	AISI 316
6	2	Stem Seal	RPTFE
7	1	Stem Packing	Graphite
8	1	Packing Nut Gland	AISI 304
9	1	Lock Washer	AISI 304
10	1	Nut	A2-70
11	1	Handle	SS 201
12	1	Handle Sleeve	Vinyl

NAVCO®

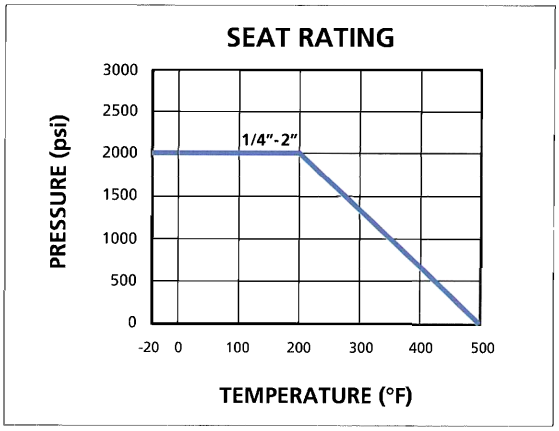
NAVCO® S20 BALL VALVE





DIMENSIONS in. (mm)

SIZE	OD	L	E	H
1/4 (6.4)	0.42 (10.7)	2.36 (59.9)	3.93 (99.8)	1.89 (48.1)
3/8 (9.7)	0.49 (12.4)	2.36 (59.9)	3.93 (99.8)	1.89 (48.1)
1/2 (12.7)	0.59 (15.0)	2.95 (74.9)	4.33 (110.0)	2.28 (57.9)
3/4 (19.1)	0.78 (19.8)	3.15 (80.0)	4.72 (119.9)	2.36 (59.9)
1 (25.4)	0.98 (24.9)	3.54 (89.9)	5.90 (149.9)	3.03 (77.0)
1 1/2 (38.1)	1.50 (38.1)	4.72 (119.9)	7.08 (179.8)	3.62 (92.0)
2 (50.8)	1.97 (50.0)	5.51 (140.0)	7.08 (179.9)	4.13 (104.9)



CAMERON
VALVES & MEASUREMENT
3250 Briarpark Drive, Suite 300
Houston, Texas 77042
USA Toll Free 800 323 9160

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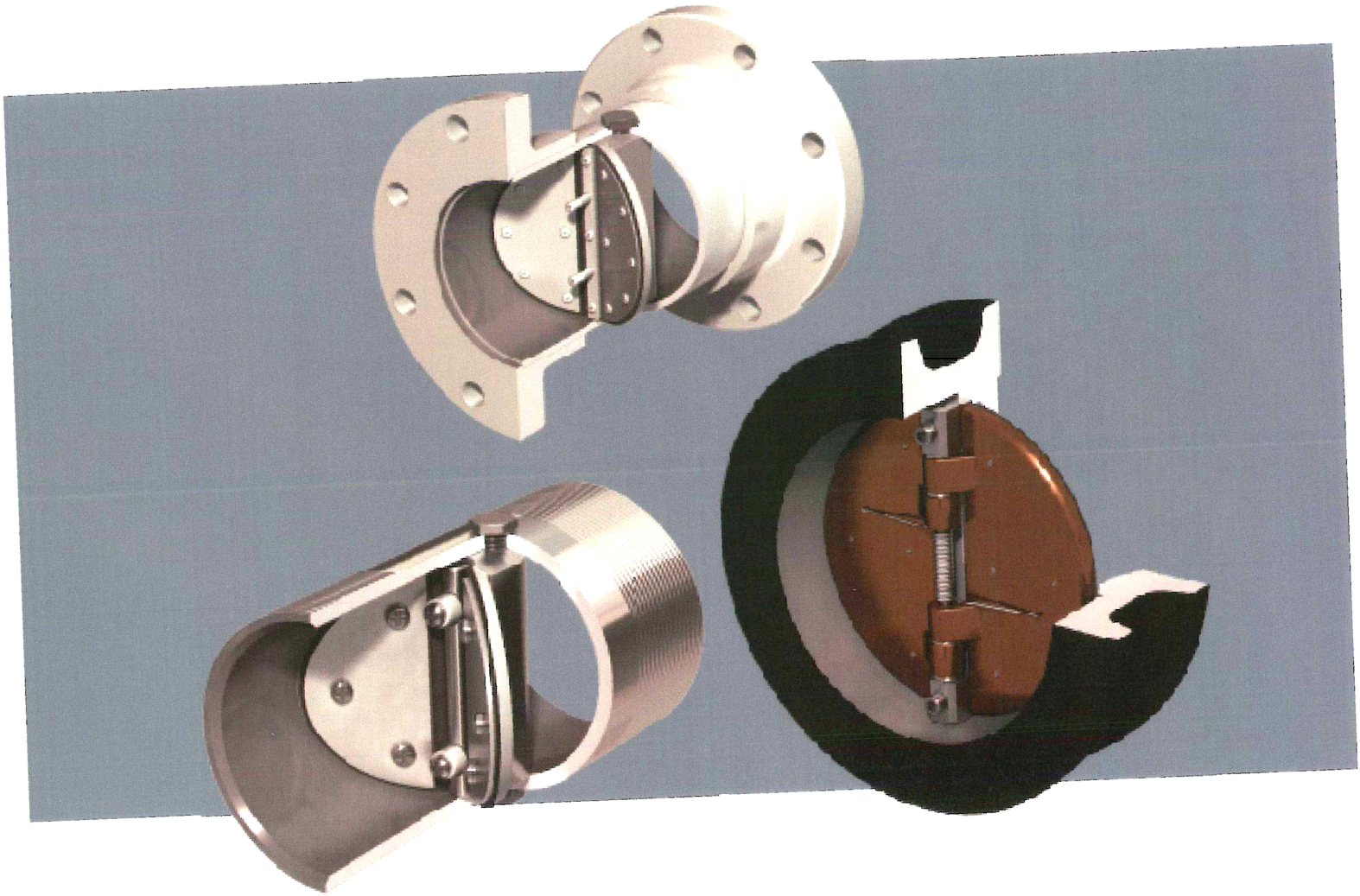
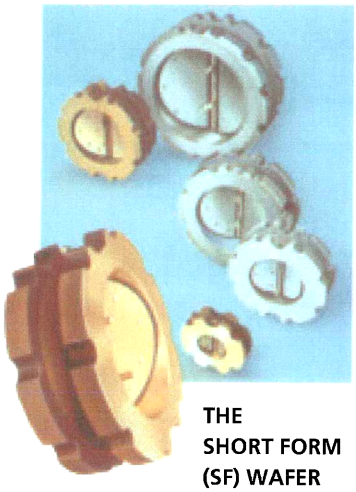
TECHNO™
Multi-Purpose Check Valves for Industry



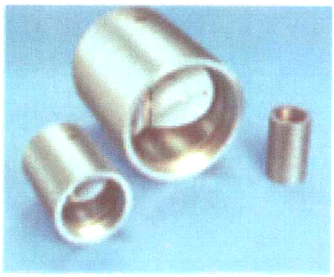
TECHNO™

MULTI-PURPOSE CHECK VALVES FOR INDUSTRY



THE SHORT FORM (SF) WAFER IS THE PERFECT DESIGN FOR AIR SERVICE AND LIGHT DUTY LIQUID APPLICATIONS. AVAILABLE IN SIZES 1" - 72"

MALE THREADED ENDS, GROOVED ENDS, PLAIN ENDS: AVAILABLE IN SIZES 1" - 20"

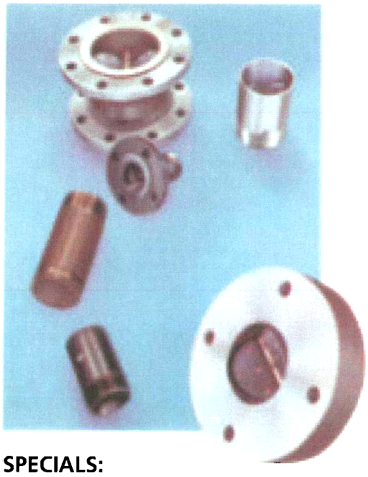


DEEP WELL: FEMALE THREADED VALVE DESIGNED FOR DEEP WELL APPLICATIONS DOWN TO 1000 FEET, AVAILABLE IN SIZES 1" - 12"

FULL FLANGED: 125#, 150# AND 300# AVAILABLE IN SIZES 1" - 48"

EXI-CHECK: INCREASER/DECREASER CHECK VALVES IDEAL FOR PUMP AND BLOWER DISCHARGE APPLICATIONS.

THERMOPLASTIC VALVES: PVC, CPVC. PP AND PVDF; FLANGED, THREADED, PLAIN, GROOVED ENDS AND WAFER STYLE; AVAILABLE IN SIZES 1" - 24"



SPECIALS: WHERE CUSTOM DESIGN IS THE RULE - NOT THE EXCEPTION - CALL ON TECHNO.

MULTI-PURPOSE CHECK VALVES FOR INDUSTRY

ELASTOMER HINGE DESIGN

DESIGN FEATURES:

Unrestricted Full Port Seatless Design

- Maximum Flow Area
- Minimum Pressure Drop

Elimination of Metal-to-Metal Rotating Parts

- No Pins to Wear
- No Seats to Wear
- No Routine Maintenance
- No Spring to Break

Non-Slam Quick Closure Feature

- Minimum Travel of Valve Plates from Full Open to Full Closed Position Reduces Closing Time
- Elimination of Spring Restricts "Slamming" Action

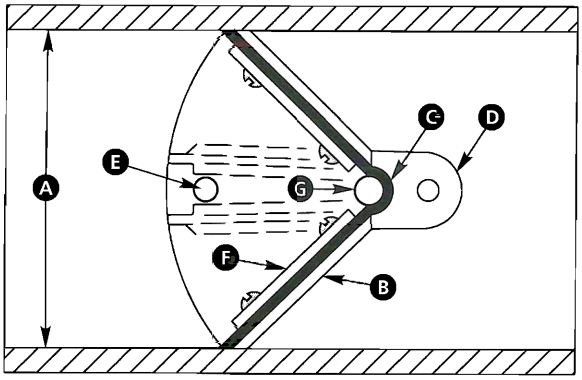
Tight Shut-Off Feature

- Flexible Elastomer Provides Perfect Seal
- Seals Tightly at Extremely Low Back Pressure

CAN BE MOUNTED IN ALMOST ANY POSITION

STANDARD MATERIALS & CONFIGURATION

BODY MATERIALS	
METALS	**THERMOPLASTIC**
• ALUMINUM	• PVC
• BRONZE/BRASS	• CPVC
• CAST IRON	• PP
• CARBON STEEL	• PVDF
• 316 STAINLESS STEEL	
INTERNAL MATERIALS	
METALS	**THERMOPLASTIC**
• ALUMINUM	• PVC
• BRASS	• CPVC
• PLATED STEEL	• PP
• 316 STAINLESS STEEL	• PVDF
ELASTOMER MATERIALS	
MATERIALS	*** TEMPERATURE RANGE**
• BUNA-N	-60°F TO 225°F
• EPDM	-40°F TO 225°F
• NEOPRENE	-40°F TO 225°F
• VITON	-20°F TO 400°F
• SILICONE	-100°F TO 500°F
BODY CONFIGURATIONS	
• MALE THREADED ENDS	• FLANGED ENDS
• FEMALE THREADED ENDS	• WAFER STYLE
• PLAIN ENDS	• INCREASER/DECREASER
• GROOVED ENDS	• COMBINATIONS



A. FULL PORT
Provides maximum flow with minimum pressure loss.

B. VALVE PLATES
Offer Metal-to-Metal support and minimum travel.

C. SEALING MEMBER
Provides Tight Shut-Off and prolonged cycle life.

D. HINGE POST
Precision air foil design offers streamlined flow.

E. TRAVEL STOP
Prevents over-travel of plates. Location is size dependent, smaller valves have stops attached to hinge clamp.

F. CLAMP PLATE
Provides added support.

G. HINGE CLAMP
Remains stationary, no Metal-to-Metal rotation.

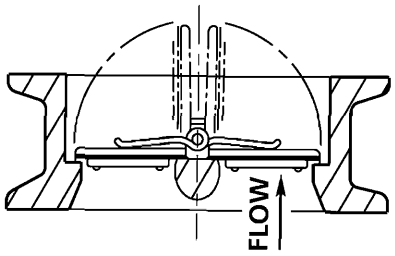
* Temperature range is for general guidance. The figures may vary with application and body/internal materials. Consult factory for materials, sizes and pressure ratings not shown as standard.

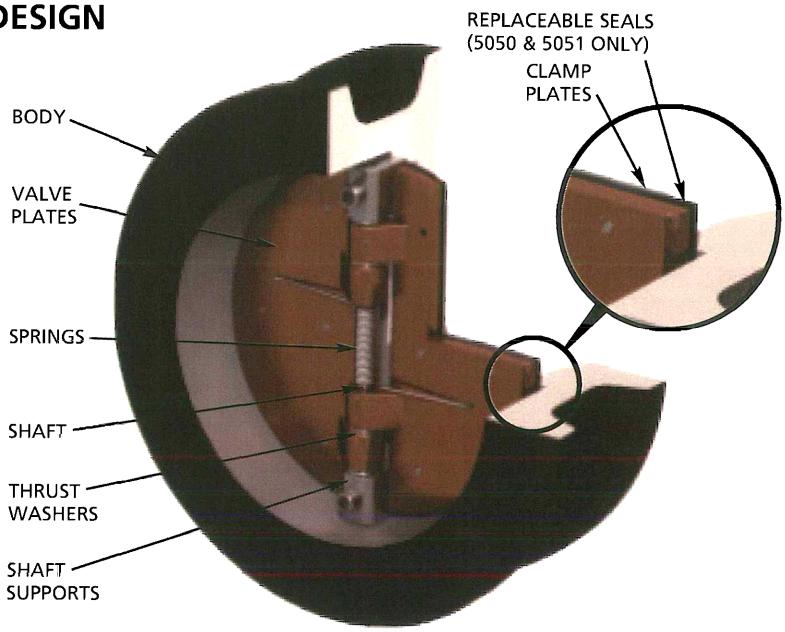
MULTI-PURPOSE CHECK VALVES FOR INDUSTRY

TECHNO'S METAL HINGED DESIGN

The industry has long awaited the Dual Plate Metal Hinged Check Valve that offers the innovative features of the new TECHNO design.

The ease of maintenance, the exceptional flow characteristics and the insurance of safety by elimination of body leakage, allows this check valve to be the engineer's dream.





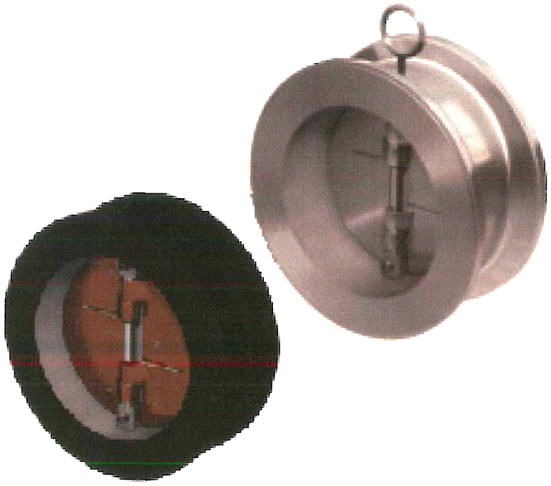
STANDARD MODELS AND MATERIALS OF CONSTRUCTION

STYLE	BODY	VALVE PLATES	SEALS	SPRINGS	TRIM*	ASME CLASS
5050	Cast Iron	Bronze	EPDM	316 Stainless Steel	316 Stainless Steel	125
5051	Carbon Steel	Carbon Steel ++	Buna-N	316 Stainless Steel	316 Stainless Steel	150
5051-316	316 Stainless Steel	316 Stainless Steel	Buna-N	316 Stainless Steel	316 Stainless Steel	150
5053	Carbon Steel	Carbon Steel ++	Buna-N	316 Stainless Steel	316 Stainless Steel	300
5053-316	316 Stainless Steel	316 Stainless Steel	Buna-N	316 Stainless Steel	316 Stainless Steel	300
5056	Carbon Steel	Carbon Steel ++	Buna-N	316 Stainless Steel	316 Stainless Steel	600
5056-316	316 Stainless Steel	316 Stainless Steel	Buna-N	316 Stainless Steel	316 Stainless Steel	600

* Trim items include: Shaft Supports, Clamp Plates and Fasteners. Teflon Thrust Washers are Standard Through 12" Size.
++ 316 Stainless Steel Valve Plates Standard on 2" to 6" Sizes.

OPTIONAL MATERIALS SELECTION

SPRING DATA	
MATERIALS	**TEMPERATURE RANGE****
• INCONEL 600	TO 750°F
• INCONEL X-750	TO 1000°F
SEAL DATA	
MATERIALS	**TEMPERATURE RANGE****
• Buna-N	-60°F TO 225°F
• FDA Approved White Neoprene	-40°F TO 225°F
• EPDM	-40°F TO 300°F
• Viton	-20°F TO 400°F
• Teflon	-20°F TO 450°F
• Silicone	-90°F TO 500°F
• Metal-to-Metal +	-400°F TO 1000°F



** This temperature is for general guidance.
The figures may vary with application and body/internal materials.
\+ 316 Stainless Steel Thrust Washers are Standard with Metal-to-Metal Seal Option.

MULTI-PURPOSE CHECK VALVES FOR INDUSTRY

DATE: _____

TECHNO CUSTOMER SERVICE: _____

PO# _____

CUSTOMER CONTACT: _____

CUSTOMER PHONE: _____

CUSTOMER FAX: _____

REQUESTED DELIVERY: _____

We have added this sheet for your convenience. You may make photocopies as necessary. When using this form as a purchase order or for quoting please fill out all necessary information and fax to our Customer Service Department at (508) 713-4850

Please quote the following item(s):

Quantity Item #'s:

Techno Use Only: _____ Notes:

Date Received: _____ _____

Time Received: _____ _____

Entered: _____ _____

Sales Order Number: _____ _____

MULTI-PURPOSE CHECK VALVES FOR INDUSTRY

SIZE

1.0 = 1"
1.3 = 1 1/4"
1.5 = 1 1/2"
2.0 = 2"
2.5 = 2 1/2"
3.0 = 3"
4.0 = 4"
5.0 = 5"
6.0 = 6"
8.0 = 8"
10.0 = 10"
12.0 = 12"
thru
72.0 = 72"
Exi-Checks:
E01 = 1.5 x 2
E02 = 2 x 2.5
E03 = 2 x 3
E04 = 2.5 x 3
E05 = 2.5 x 4
E06 = 3 x 4
E07 = 3 x 6
E08 = 4 x 5
E09 = 4 x 6
E10 = 5 x 6
E11 = 6 x 8
E12 = 8 x 10
E13 = 10 x 12
E14 = 12 x 14
E15 = 14 x 16
E16 = 16 x 18
E17 = 18 x 20
E18 = 20 x 24
E19 = 24 x 30
E20 = 30 x 36
E21 = 3 x 5
E22 = 5 x 8
E23 = 2 x 4
XXX = Other**

VALVE SERIES

DPW = Dual Plate Wafer Check, ASME rated 5050, 5051, 5053, 5056

EHF = Elastomer Hinge Flanged 5001, 5003, 5004, 5102, 5107, 5116, 5117

EHW = Elastomer Hinge Short Form Wafer 5005, 5412, 5118, 5831, 5355, 5296, 5865, 5881, 5297(300#)

EHL = Elastomer Hinge Short Form Lug (5463) 5463-300

EHB = Elastomer Hinge long Pattern Flanged (5081) (for direct flanging to b'fly valves) 5081-R (RF), 5081-F (FF)

EHT = Elastomer Hinge Threaded Valve (5000, 5002)

EHV = Elastomer Hinge Victaulic Grooved Valve (5103)

EHP = Elastomer Hinge Plain End Valve (5104)

EHS = Elastomer Hinge Sanitary Ends (5922)

SCW = Swing Check Metal Wafer Valves, ASME (1200)

SCN = Narrow Profile Tilting Disc Swing Check Valves (100, 110)

XXX = Other**

BODY MATERIAL

A2 = Alloy 20
AB = Allum Bronze
AL = Alluminum
BR = Brass
BZ = Bronze
CI = Cast Iron
CP = CPVC
CS = Carbon Steel
DI = Ductile Iron
DS = Duplex Stainless Steel
HB = Hastelloy B
HC = Hastelloy C
LC = Low Carbon Steel
M4 = Monel 400
M5 = Monel K500
PP = Polypropylene
PC = PVC
PD = PVDF (Kynar)
PS = Plated Carbon Steel
T2 = Titanium Gr. 2
WC = Cast Steel, A216 Gade WCB
34 = 304 Stainless Steel
36 = 316 Stainless Steel
42 = 410 Stainless Steel
4L = 304L Stainless Steel
6L = 316L Stainless Steel
XX = Other**

INTERNALS MATERIAL

A2 = Alloy 20
AB = Allum Bronze
AL = Alluminum
BR = Brass
BZ = Bronze
CI = Cast Iron
CP = CPVC
CS = Carbon Steel
DI = Ductile Iron
DS = Duplex Stainless Steel
HB = Hastelloy B
HC = Hastelloy C
LC = Low Carbon Steel
M4 = Monel 400
M5 = Monel K500
PP = Polypropylene
PC = PVC
PD = PVDF (Kynar)
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34 = 304 Stainless Steel
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42 = 410 Stainless Steel
4L = 304L Stainless Steel
6L = 316L Stainless Steel
XX = Other**

☐ ☐ ☐	☐ ☐ ☐	☐ ☐	☐ ☐
SIZE	VALVE SERIES	BODY MATERIAL	INTERNALS MATERIAL

Sample:

6 . 0	E H T	C S	P S

MULTI-PURPOSE CHECK VALVES FOR INDUSTRY

SEAL MATERIAL

B = Buna-N
U = EPDM
E = Butyl
H = Hypalon
M = Metal (Metal Hinge Valves Only)
N = Neoprene
S = Silicone
T = Teflon (Metal Hinge Valves Only)
V = Viton A
W = FDA Approved White Neoprene (Metal Hinge Valves Only)
X = Other**

SPRING MATERIAL

32 = 302 SS
36 = 316 SS
HB = Hastelloy B
HC = Hastelloy C
60 = Inconel 600
75 = Inconel X-750
M4 = Monel 400
NS = No Spring
XX = Other**

VALVE RATING

A12 = ASME 125
A15 = ASME 150
A30 = ASME 300
A60 = ASME 600
030 = 30 psi-cwp
050 = 50 psi-cwp
100 = 100 psi-cwp
125 = 125 psi-cwp
150 = 150 psi-cwp
300 = 300 psi-cwp
450 = 450 psi-cwp
XXX = Other**

END CONNECTIONS

RF = Raised Face
FF = Flat Face
MP = Male Threaded Ends
FP = Female Threaded Ends
TC = Tri-Clamp Ends
VC = Victaulic Grooved
PE = Plain Ends
XX = Other**

OPTIONS*

Consult factory for options such as:

Epoxy Coat
Drain Holes
Bypass Holes
Special Ports
Special Paint
Fasteners
etc.

* **Techno assigns option suffix numbers to identify special valves.**

Once an option number is assigned to specify the special valve, that number can then be used to reorder an identical valve. Consult factory for options.

** Other: "X" or "XX" or "XXX" indicates a choice other than standards shown.

Note: Certain combinations are not available.

TRADEMARK INFORMATION

TECHNO™ is a registered trademark which is owned by Cameron.

This document contains references to registered trademarks or product designations, which are not owned by Cameron.

Trademark	Owner
HASTELLOY	Haynes International, Inc
HYPALON	E.I. DuPont De Nemours & Company
INCONEL	INCO Nickel Sales, Inc.
MONEL	INCO Alloys International, Inc.
NEOPRENE	E.I. DuPont De Nemours & Company
STELLITE	Stoody Deloro Stellite, Inc.
TEFLON	E.I. DuPont De Nemours & Company
VITON	E.I. DuPont De Nemours & Company

CERTIFICATIONS

SEAL MATERIAL	SPRING MATERIAL	VALVE RATING	END CONNECTIONS	OPTIONS
B	3 2	1 5 0	M P	1 4 5

CAMERON

VALVES & MEASUREMENT
3250 Briarpark Drive, Suite 300
Houston, Texas 77042
USA Toll Free 800 323 9160

For the most current contact and location information go to: www.c-a-m.com/valvesandmeasurement

Printed in Canada Revised 07/08-ION-5M BR-TEC-GENERAL

Type 57 Butterfly Valve

Specifications

Sizes:	Lever: 1-1/2" – 8" Gear: 8" – 14"
Models:	Wafer Style
Operators:	Lever and Gear
Bodies:	PVC, PP and PVDF
Discs:	PVC, PP and PVDF
Seats:	EPDM, FKM, and Nitrile
Seals:	Same as seating material
Stems:	403 and 316 stainless steel, Titanium, Hastelloy C® ‡

‡ Trademark of Cabot Corporation

Standard Features (Sizes 1-1/2" – 14")

- Standard model (1-1/2" – 14") has PVC Body and PP Disc for superior chemical resistance and elevated temperature capabilities
- 316/403 stainless steel shaft has full engagement over the entire length of the disc and is a non-wetted part.
- Only solid and abrasion-resistant plastic disc and elastomeric liner are wetted parts.
- ISO bolt circle on top flange–no body or stem modifications required for accessories.
- Stem retainer–PP retainer to prevent stem removal.
- Seat over tightening protection–Molded body stops and seat stress relief area.
- Spherical disc design offers increased Cv, ultimate sealing and high cycle life.

Options

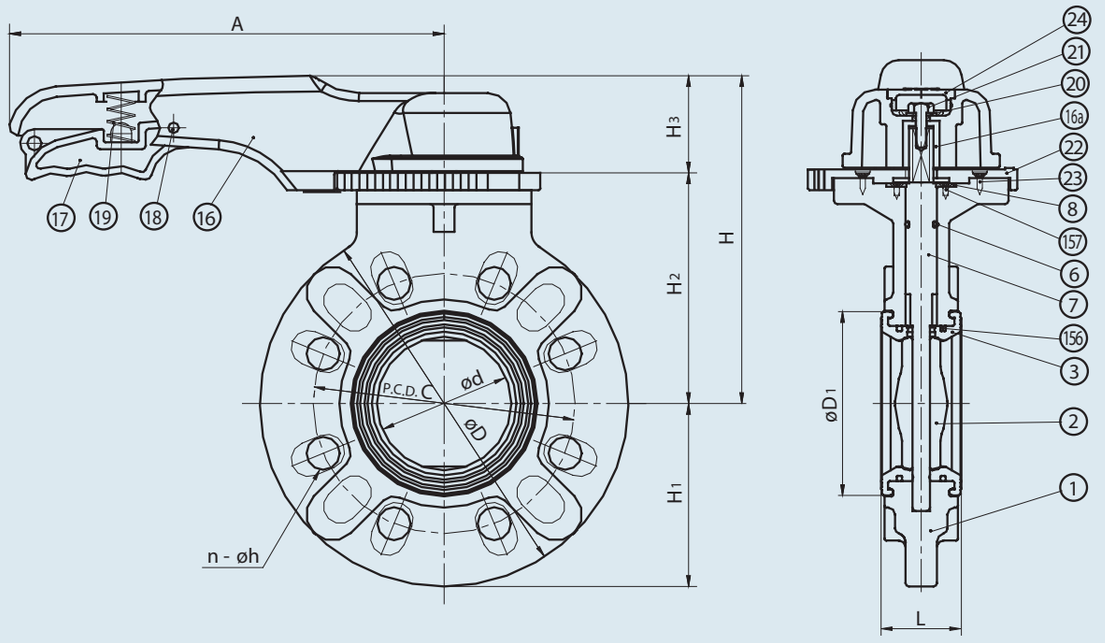
- Pneumatically and electrically actuated with accessories
- Alternate discs:

  (I) PVC : 1-1/2" – 14"
  (II) PVDF : 1-1/2" – 14"
- Plasgear™ gear operators for 1-1/2"– 6"
- Lug style (stainless steel 304 or 316) for blocking and end-of-line applications
- Stems in 316 stainless steel, titanium, Hastelloy C®.
- 2" square nut on stem (1-1/2" - 8" only)
- 2" square nut on gear operator (All sizes)
- Stem extensions (Single stem and two-piece stem)
- Locking devices (Gear Type – Standard on Lever)
- Chain operators
- Manual limit switch - Asahi P-Series
- Tandem arrangements (Patented by A/A, Inc.)

Parts List (Lever: Sizes 1-1/2" – 8")

PARTS			
NO.	DESCRIPTION	PCS.	MATERIAL
1	Body	1	PVC, PP, PVDF
2	Disc	1	PVC, PP, PVDF
3	Seat	1	EPDM, FKM, NBR
6	O-Ring (C)	1	EPDM, FKM, NBR
7	Stem	1	Stainless Steel 316
8	Stem Retainer	1	PP
16	Handle	1	PP
16a	Metal Insert in Handle	1	Stainless Steel 316L
17	Handle Lever	1	PPG
18	Pin	1	PPG
19	Spring	1	Stainless Steel 304
20	Washer (A)	1	Stainless Steel 304
21	Bolt (B)	1	Stainless Steel 304
22	Locking Plate	1	PPG
23	Screw (B)	4	Stainless Steel 304
24	Cap (A)	1	PP
156	Liner Stabilization Ring	2	Stainless Steel (SCS13)
157	Screw (F)	4	Stainless Steel 304

Type 57 – Lever Operated Butterfly Valves



Dimensions (Lever: Sizes 1-1/2" – 8")

NOMINAL SIZE			ANSI CLASS 150										
INCHES	mm	d	C	n	h	D	D1	L	H	H1	H2	H3	A
1 1/2	40	1.77	3.88	4	0.62	5.91	2.83	1.54	6.14	2.95	3.94	2.20	8.66
2	50	2.20	4.75	4	0.75	6.50	3.23	1.65	6.54	3.25	4.33	2.20	8.66
2 1/2	65	2.72	5.50	4	0.75	7.28	3.78	1.81	6.93	3.64	4.72	2.20	8.66
3	80	3.03	6.00	4	0.75	8.31	4.17	1.81	7.52	4.15	5.31	2.20	9.84
4	100	4.02	7.50	8	0.75	9.37	5.31	2.20	8.11	4.69	5.91	2.20	9.84
5	125	5.08	8.50	8	0.88	10.39	6.69	2.60	9.33	5.20	6.61	2.72	12.60
6	150	5.91	9.50	8	0.88	11.22	7.52	2.80	9.92	5.61	7.20	2.72	12.60
8	200	7.68	11.75	8	0.88	13.39	9.53	3.43	11.14	6.69	8.43	2.72	15.75

Cv Values

NOMINAL SIZE		Cv (at various opening degrees)		
INCHES	mm	30°	60°	90°
1 1/2	40	4	43	71
2	50	7	73	120
2 1/2	65	15	153	250
3	80	18	183	300
4	100	28	287	470
5	125	49	506	830
6	150	66	671	1100
8	200	150	1525	2500

Pressure vs. Temperature (PSI, WATER, NON-SHOCK)* Wt. (LBS) / Vacuum Service

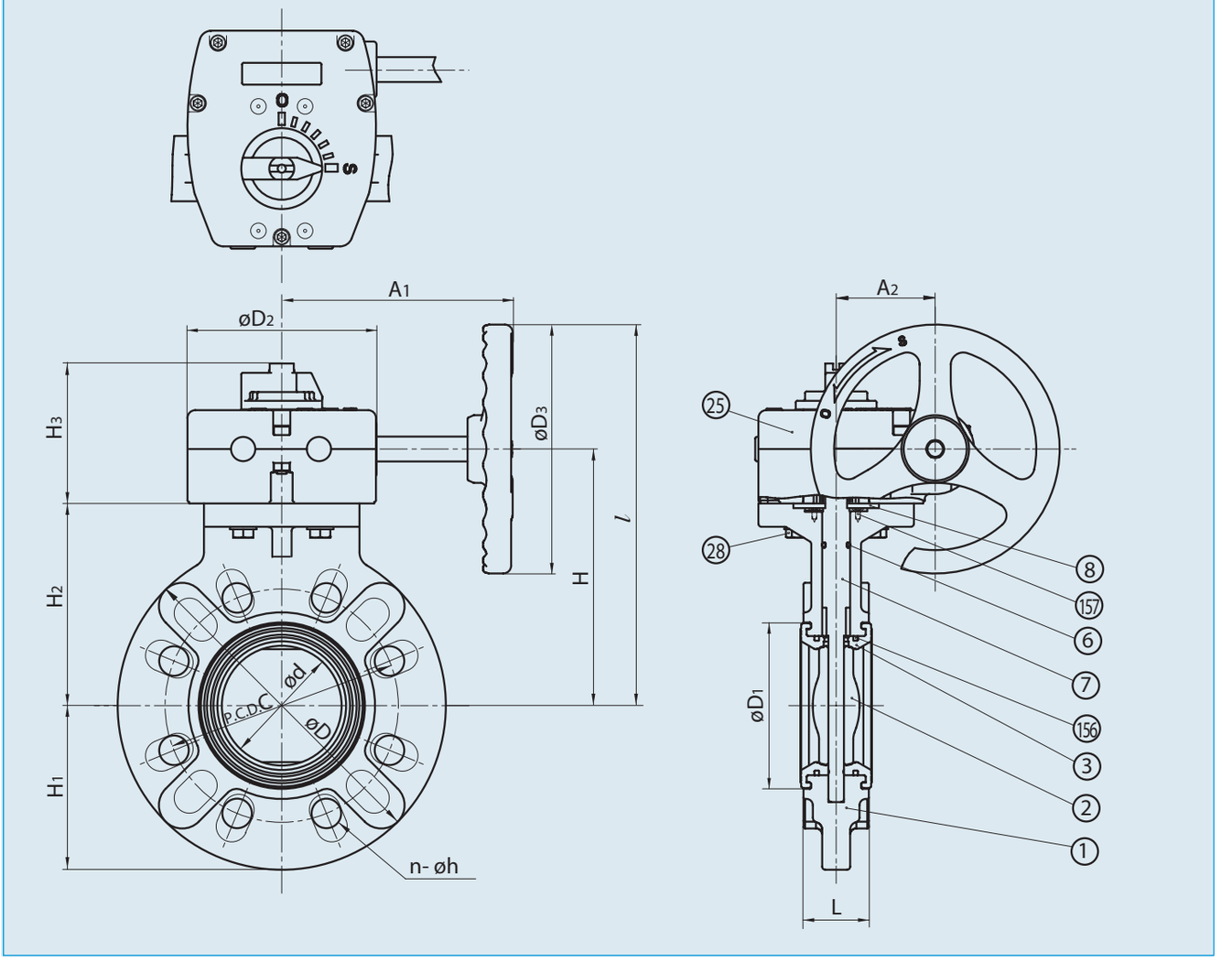
BODY		PVC			PP		PVDF			
DISC		PP			PP		PVDF			
NOMINAL SIZE		30° F 120° F	121° F 140° F	141° F 175° F	-5° F 140° F	141° F 175° F	-5° F 140° F	141° F 175° F	176° F 210° F	211° F 250° F
INCHES	mm									
1 1/2	40	150	70	30	150	100	150	100	85	75
2	50	150	70	30	150	100	150	100	85	75
2 1/2	65	150	70	30	150	100	150	100	85	75
3	80	150	70	30	150	100	150	100	85	75
4	100	150	45	30	150	100	150	100	85	75
5	125	150	45	30	150	100	150	100	85	75
6	150	150	45	30	150	100	150	100	85	75
8	200	150	40	20	150	85	150	85	75	60

NOMINAL SIZE		PVC	PP	PVDF
INCHES	mm			
1 1/2	40	3	3	3
2	50	4	3	4
2 1/2	65	4	3	4
3	80	5	4	5
4	100	6	5	7
5	125	11	9	13
6	150	13	10	15
8	200	21	16	25

NOMINAL SIZE		VACUUM SERVICE (INCHES OF MERCURY)
INCHES	mm	
1 1/2	40	-29.92
2	50	-29.92
2 1/2	65	-29.92
3	80	-29.92
4	100	-29.92
5	125	-29.92
6	150	-29.92
8	200	-29.92

* For lug style data consult factory

Type 57 – Gear Operated Butterfly Valves



Dimensions (Sizes 1-1/2" – 14") (NOTE: GEAR OPERATED VALVE IS STANDARD 8" – 14"; SIZES 1-1/2 " – 6" ARE OPTIONS.)

NOMINAL SIZE			ANSI CLASS 150																Gear Box Model No.
INCHES	mm	d	C	n	h	D	D1	D2	D3	L	H	H1	H2	H3	l	A1	A2	Wheel Cycles	
1 1/2	40	1.77	3.88	4	0.62	5.91	2.83	4.80	6.30	1.54	5.12	2.95	3.74	3.54	8.27	6.57	2.52	9.5	241
2	50	2.20	4.75	4	0.75	6.50	3.23	4.80	6.30	1.65	5.51	3.25	4.13	3.54	8.66	6.57	2.52	9.5	
2 1/2	65	2.72	5.50	4	0.75	7.28	3.78	4.80	6.30	1.81	5.91	3.64	4.53	3.54	9.06	6.57	2.52	9.5	
3	80	3.03	6.00	4	0.75	8.31	4.17	4.80	6.30	1.81	6.50	4.15	5.12	3.54	9.65	6.57	2.52	9.5	
4	100	4.02	7.50	8	0.75	9.37	5.31	4.80	6.30	2.20	7.09	4.69	5.71	3.54	10.24	6.57	2.52	9.5	
5	125	5.08	8.50	8	0.88	10.39	6.69	4.80	6.30	2.60	7.68	5.20	6.30	3.54	10.83	6.57	2.52	9.5	
6	150	5.91	9.50	8	0.88	11.22	7.52	4.80	6.30	2.80	8.27	5.61	6.89	3.54	11.42	6.57	2.52	9.5	
8	200	7.68	11.75	8	0.88	13.39	9.53	4.80	6.30	3.43	9.49	6.69	8.11	3.54	12.64	6.57	2.52	9.5	
10	250	9.84	14.25	12	1.00	16.57	11.89	4.80	6.30	4.33	10.87	8.31	9.49	3.62	14.02	6.57	2.52	9.5	
12	300	11.93	17.00	12	1.00	19.21	14.17	7.40	11.81	5.08	13.39	9.61	11.73	4.25	19.29	9.53	3.90	9.5	243
14	350	13.82	18.75	12	1.12	21.22	15.47	7.40	11.81	5.08	14.45	10.63	12.80	4.25	20.35	9.53	3.90	9.5	

Type 57 – Gear Operated Butterfly Valves

Parts List (Gear: Sizes 1-1/2" – 14")

PARTS			
NO.	DESCRIPTION	PCS.	MATERIAL
1	Body	1	PVC, PP, PVDF
2	Disc	1	PVC, PP, PVDF
3	Seat	1	EPDM, FKM, NBR
6	O-Ring (C)	1	EPDM, FKM, NBR
7	Stem	1	Stainless Steel 316, 403
8	Stem Retainer	1	PP
25	Gear Box	1	Plasgear™
28	Bolt (C)	4	Stainless Steel 304
156	Liner Stabilization Ring	2	Stainless Steel (SCS13)
157	Screw (F)	4	Stainless Steel 304

Troubleshooting

What if fluid still flows when the valve is closed?

1. Make sure lever or gear is in a fully closed position (gear type may require travel stop adjustment].
2. Liner is damaged or worn. Replace liner.
3. Disc is damaged or abraded. Change disc.
4. Foreign material is caught between seat and disc. Remove the substance.
5. Mating flange bolts either over-tightened or unevenly tightened. Retighten properly.

What if fluid leaks outside between seat and mating flange?

1. Seat damage. Change seat.
2. Mating flange bolts not tightened with proper torque or unevenly tightened. Retighten to the appropriate torque.

What if valve does not operate smoothly?

1. Foreign material is caught between disc and seat. Remove the material and clean.
2. Lever or gearbox is damaged. Replace.
3. Mating flange bolts over-tightened. Retighten.

Sample Specification

All solid thermoplastic butterfly valves sizes 1-1/2" thru 14" shall be of the TYPE 57 lined body design and bubble-tight seal (meeting or exceeding Class VI as defined by American National Standard Institute) with only the liner and disc as wetted parts. The lever handle (sizes 1-1/2" thru 8") shall have a molded provision for a padlock. Gear operators shall be worm gear design, self locking Plasgear.™ The spherical disc design for higher Cv values shall be of solid, abrasion-resistant plastic. Liner shall be molded and formed around the body, functioning as gasket seals with convex ring design on each side of the valve for lower bolt tightening torque and valve body shall have molded body stops and seat relief area to prevent over tightening of mating flanges. Stem shall be of 316/403 stainless steel, non wetted, have engagement over the full length of the disc and be locked into valve body by PP stem retainer. Valves shall have a molded ISO bolt pattern on top flange for actuator mount. PVC shall conform to ASTM D1784 Cell Classification 12454-A, PP conforming to ASTM D4101 Cell Classification PP0210B67272, and PVDF conforming to ASTM D 3222 Cell Classification Type II. All PVC PP and PVDF body valves shall be rated to 150 psi at 70 degrees F, sizes 1-1/2" thru 10" and 100 psi for sizes 12" and 14". Butterfly valves shall be wafer style, as manufactured by Asahi/America Inc.

Caution

- Never remove valve from pipeline under pressure.
- Always wear protective gloves and goggles.

Cv Values

NOMINAL SIZE		Cv (at various opening degrees)		
INCHES	mm	30°	60°	90°
8	200	150	1525	2500
10	250	232	2355	3860
12	300	342	3477	5700
14	350	386	3928	6440

Pressure vs. Temperature (PSI, WATER, NON-SHOCK)*

BODY		PVC			PP		PVDF			
DISC		PP			PP		PVDF			
NOMINAL SIZE		30° F 120° F	121° F 140° F	141° F 175° F	-5° F 140° F	141° F 175° F	-5° F 140° F	141° F 175° F	176° F 210° F	211° F 250° F
INCHES	mm									
8	200	150	40	20	150	85	150	85	75	60
10	250	150	40	20	150	85	150	85	75	60
12	300	100	30	15	100	60	100	60	45	30
14	350	100	30	7	100	45	100	45	30	15

* For lug style data consult factory

Wt. (LBS)

NOMINAL SIZE		PVC	PP	PVDF
INCHES	mm			
8	200	24	20	28
10	250	33	27	41
12	300	62	53	76
14	350	67	58	81

/Vacuum Service

NOMINAL SIZE		VACUUM SERVICE (INCHES OF MERCURY)
INCHES	mm	
8	200	-29.92
10	250	-29.92
12	300	-23.62
14	350	-23.62

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- CPVC FlowGuard Gold®
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Gate Valves (Socket)

Features:

- Polypropylene wedge for smooth sealing and longer service (EPDM O'ring).
- Meets/exceeds ASTM schedule 40 dimensional and material standards.
- Strong non-rising stem construction.
- Made of high-impact PVC Type II material.
- Molded in the USA by KBI.
- Pressure rated to 150 psi @ 73°F nominal operating pressure.
- NSF Standard 61 listed.

Model	Size	Connection	Case	Weight
GVP-0500-T	1/2"	Socket	24	8.8
GVP-0750-T	3/4"	Socket	20	8.5
GVP-1000-T	1"	Socket	16	8.5
GVP-1250-T	1 1/4"	Socket	8	8.6
GVP-1500-T	1 1/2"	Socket	6	6.7
GVP-2000-T	2"	Socket	4	7.6

Some fields might not be applicable for all products

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TRUE UNION 2000 INDUSTRIAL BALL CHECK VALVES

Features – PVC, CPVC

Flow tested design provides quick response with positive seal for prevention of system back flow in industrial and chemical processing applications. Valves are available in IPS sizes 1/2" through 6" with socket/regular thread, SR threaded (Special Reinforced), flanged or spigot end connectors and 8" venturied valve with socket or flanged ends. Also available in metric socket and BSP thread sizes 1/2" through 2".

- Chemical & Corrosion Resistant PVC or CPVC Construction
- Also Available in Spears® LXT™ High Purity,Low Extractable PVC Material
- Strong, Buttress Thread Union Nuts
- Spears® Safe-T-Blocked® Seal Carrier
- Uses Standard O-ring Seat
- EPDM or Viton® O-rings
- Fully Serviceable, Replaceable Components
- Sizes 1/2" - 4" Pressure Rated to 235 psi @ 73°F, Sizes 6" and 8" Venturied and all Flanged Pressure Rated to 150 psi @ 73°F
- Suitable for Either Horizontal or Vertical Installations
- NSF Certified for Potable Water use
- Suitable for Vacuum Service
- Assembled with Silicone-Free, Water Soluble Lubricants
- Manufactured to ASTM F 1970

Sample Engineering Specification

All thermoplastic check valves shall be True Union 2000 Industrial Ball Check type manufactured to ASTM F 1970 and constructed from PVC Type I, ASTM D 1784, Cell Classification 12454 or CPVC Type IV, ASTM D 1784 Cell Classification 23447. All O-rings shall be EPDM or Viton®. All valve union nuts shall have Buttress threads. All valve seats shall be a standard O-ring type. All seal carriers shall be Safe-T-Blocked®. All valve components shall be replaceable. All valves shall be listed by NSF for use in potable water service. All valves shall be certified by NSF International for use in potable water service. All PVC and CPVC 1/2" through 4" valves shall be pressure rated to 235 psi, all 6" and 8" Venturied and all flanged valves shall be pressure rated to 150 psi for water at 73°F as manufactured by Spears® Manufacturing Company.

Quick-View Valve Selection Chart

Valve Size	O-ring Material	PVC Part Number[1]					Pressure Rating
		Socket	Threaded	SR Threaded	Flanged	Spigot	
1/2	EPDM	4529-005	included	4521-005SR	4523-005	4527-005	235 psi Non-Shock Water @ 73°F (Flanged 150 psi Non-Shock) Water @ 73°F
	Viton®	4539-005	included	4531-005SR	4533-005	4537-005	
3/4	EPDM	4529-007	included	4521-007SR	4523-007	4527-007	
	Viton®	4539-007	included	4531-007SR	4533-007	4537-007	
1	EPDM	4529-010	included	4521-010SR	4523-010	4527-010	
	Viton®	4539-010	included	4531-010SR	4533-010	4537-010	
1-1/4	EPDM	4529-012	included	4521-012SR	4523-012	4527-012	
	Viton®	4539-012	included	4531-012SR	4533-012	4537-012	
1-1/2	EPDM	4529-015	included	4521-015SR	4523-015	4527-015	
	Viton®	4539-015	included	4531-015SR	4533-015	4537-015	
2	EPDM	4529-020	included	4521-020SR	4523-020	4527-020	
	Viton®	4539-020	included	4531-020SR	4533-020	4537-020	
2-1/2	EPDM	4522-025	4521-025	4521-025SR	4523-025	4527-025	
	Viton®	4532-025	4531-025	4531-025SR	4533-025	4537-025	
3	EPDM	4522-030	4521-030	4521-030SR	4523-030	4527-030	
	Viton®	4532-030	4531-030	4531-030SR	4533-030	4537-030	
4	EPDM	4522-040	4521-040	4521-040SR	4523-040	4527-040	
	Viton®	4532-040	4531-040	4531-040SR	4533-040	4537-040	
6	EPDM	4522-060	4521-060	4521-060SR	4523-060	4527-060	150 psi Non-Shock Water @ 73°F
	Viton®	4532-060	4531-060	4531-060SR	4533-060	4537-060	
8[2]	EPDM	4522-080	—	—	4523-080	—	
	Viton®	4532-080	—	—	4533-080	—	

1: For CPVC valve, add the letter "C" to the part number (e.g., 4529-005**C**, 4521-005**C**SR)
2: 8" Venturied Valves are 6" ball valves fitted with 6x8 end connector adapters

Optional Accessories*

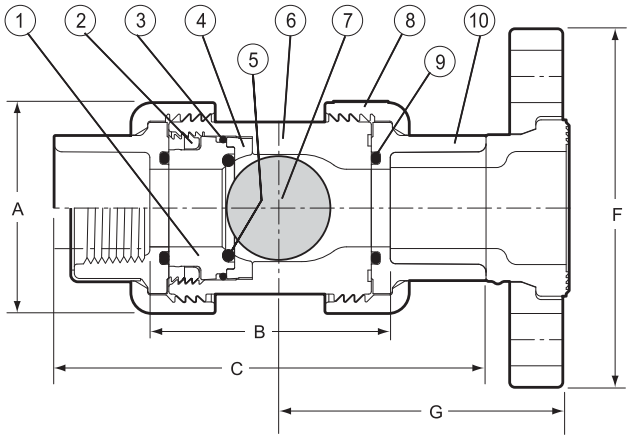
- Retro-Fit End Connector Sets for Valve Replacement
- Split-Nut Repair Kits for Union Nut Replacement
- Supplemental End Connectors

* See ***"BALL VALVE ACCESSORIES"*** section for details of individual products.

Ball Check Foot Valves

Spears® Ball Check Valves easily convert to foot valves utilizing optional Foot Valve Screen adapters found in Ball Valve Accessories section.

TRUE UNION 2000 INDUSTRIAL BALL CHECK VALVES



Replacement Parts

No.	Component	Qty.	Material
1	Seal Carrier	1	PVC/CPVC
2	Seal Carrier Nut	1	PVC/CPVC
3	Carrier O-ring	1	EPDM/Viton®
4	Seat Plate	1	PVC/CPVC
5	Seat O-ring	1	EPDM/Viton®
6	Body	1	PVC/CPVC
7	Ball	1	PVC/CPVC
8	Union Nut	2	PVC/CPVC
9	End Connector O-ring	2	EPDM/Viton®
10	End Connector	2	PVC/CPVC

Dimensions, Weights, & C_v Values

Nominal Size	Dimensions Reference (inches, ± 1/16)								Approx. Wt. (Lbs.)		Cv Values			Horizontal Closing	
	A	B[1]		C			F	G	PVC	CPVC	Soc/Thd	Flange	Spigot	Feet of Head (water)	GPM (minimum)
		Soc/Thd	Spigot	Socket	Thread	Spigot									
1/2	1-7/8	2-7/16	2-7/8	4-3/16	3-13/16	4-5/8	3-1/2	2-31/32	.30	.33	6.3	6	6.3	1.6	.10
3/4	2-1/4	2-3/4	3-1/4	4-3/4	4-1/4	5-1/4	3-7/8	3-5/16	.46	.50	17	16	17	1.6	.10
1	2-1/2	2-7/8	3-1/2	5-1/8	4-11/16	5-3/4	4-1/4	3-5/8	.70	.74	25	24	25	1.6	.25
1-1/4	3-1/16	3-1/4	3-3/16	5-3/4	5-3/16	6-5/16	4-5/8	3-31/32	1.04	1.09	65	61	65	1.6	.40
1-1/2	3-1/2	3-1/2	4	6-1/4	5-7/16	6-3/4	5	4-3/8	1.37	1.45	86	82	86	1.6	.75
2	4-1/4	4-3/4	5-3/16	7-3/4	6-3/4	8-1/4	6	5-1/4	2.47	2.62	130	125	130	1.6	.75
2-1/2	6-3/16	5-7/8	7-13/16	9-5/16	8-1/2	11-3/8	7-1/2	6	6.80	7.25	200	193	200	1.0	1.50
3	6-3/16	6-7/8	7-13/16	10-11/16	9-3/4	11-9/16	7-1/2	6-13/16	6.98	7.35	275	268	275	1.0	4.00
4	7-1/2	7-1/4	8-1/4	11-13/16	10-1/4	12-3/4	9	7-1/2	12.13	12 .96	500	489	500	1.0	5.50
6	11-5/8	11-1/6	13	17-1/16	15-3/4	18-1/2	11-1/4	10-3/16	37.07	39.98	800	794	800	N/A	N/A
8[3]	11-5/8	23-3/16	---	31-7/8	---	---	13-1/2	17-13/16	50.84	55.92	N/A	N/A	N/A	N/A	N/A

1: Valve Lay Length

2: Gallons per minute at 1 psi pressure drop. Valves calculated from laying length, based on derivative of Hazen-Williams equation with surface roughness factor of C=150.

3: 8" Venturied Valves are 6" ball valves fitted with 6x8 end connector adapters

Temperature Pressure Rating

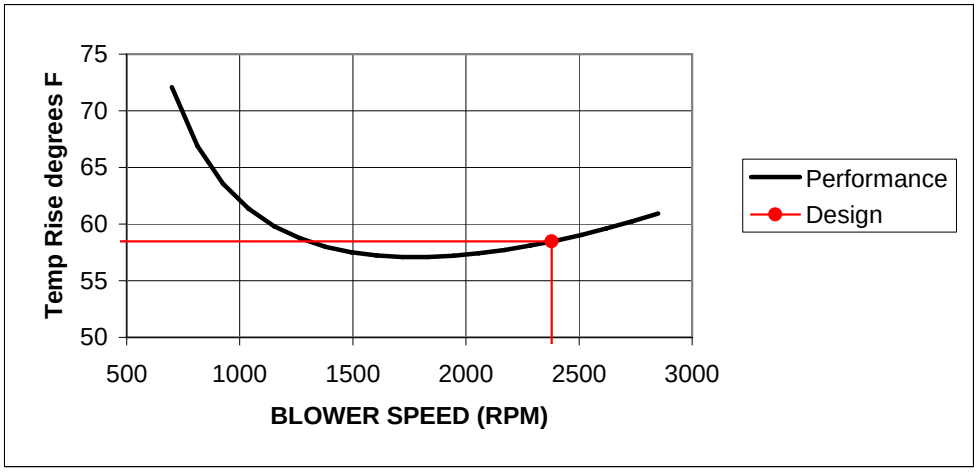
System Operating Temperature °F (°C)			100 (38)	110 (43)	120 (49)	130 (54)	140 (60)	150 (66)	160 (71)	170 (77)	180 (82)	190 (88)	200 (93)	210 (99)
Valve Pressure Rating psi (MPa)	1/2" - 4"	PVC	235 (1.62)	211 (1.45)	150 (1.03)	75 (.52)	50 (.34)	-0- (-0-)	-0- (-0-)	-0- (-0-)	-0- (-0-)	-0- (-0-)	-0- (-0-)	-0- (-0-)
		CPVC	235 (1.62)	219 (1.51)	170 (1.17)	145 (1.00)	130 (.90)	110 (.76)	90 (.62)	80 (.55)	70 (.48)	60 (.41)	50 (.34)	-0- (-0-)
	6" and 8"	PVC	150 (1.03)	135 (.93)	110 (.76)	75 (.52)	50 (.34)	-0- (-0-)	-0- (-0-)	-0- (-0-)	-0- (-0-)	-0- (-0-)	-0- (-0-)	-0- (-0-)
		CPVC	150 (1.03)	140 (.97)	130 (.90)	120 (.83)	110 (.76)	100 (.70)	90 (.62)	80 (.55)	70 (.48)	60 (.41)	50 (.34)	-0- (-0-)

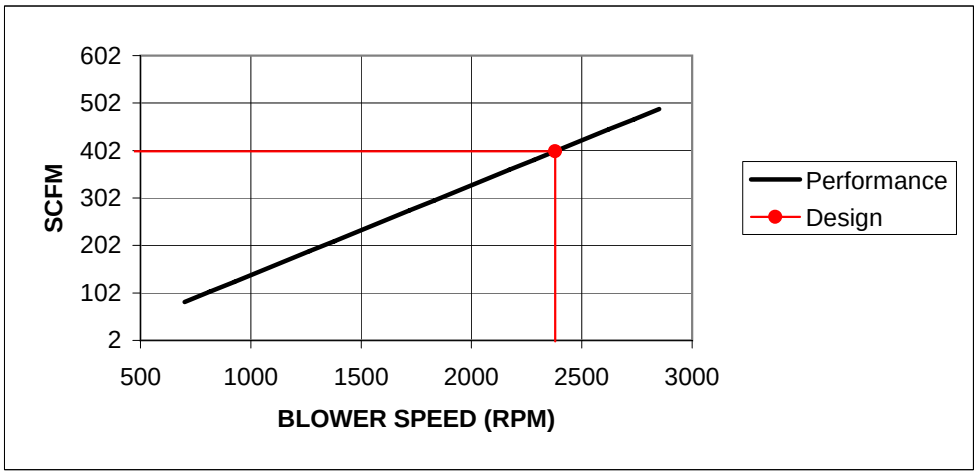
NOTE: Flanged valves have a base pressure rating of 150 psi

General Installation Information: Ball check valves may be installed in either horizontal or vertical position. A minimum of ten (10) pipe diameters distance maintained from any pump or other source of turbulence. Check valves **MUST** be installed with the valves **FLOW** arrow pointing in the direction of flow.

NOT FOR USE WITH COMPRESSED AIR OR GASES

Dresser Roots
59 URAI: Variable Speed Performance

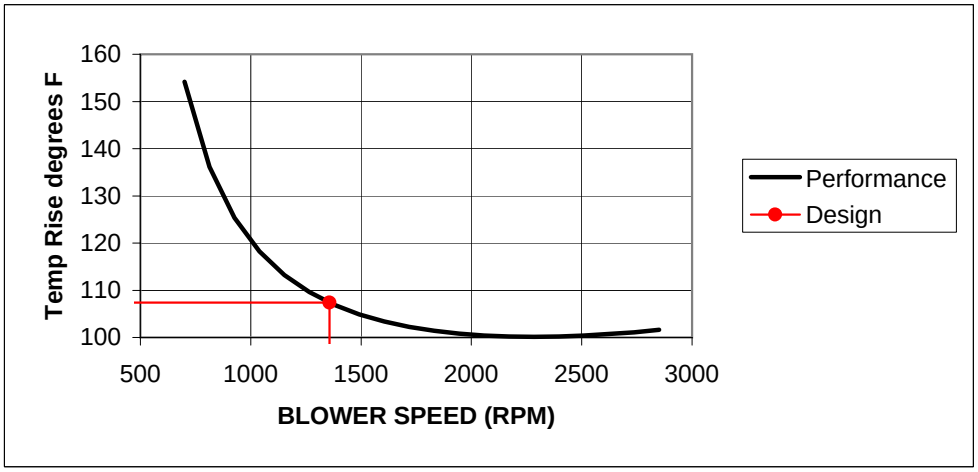


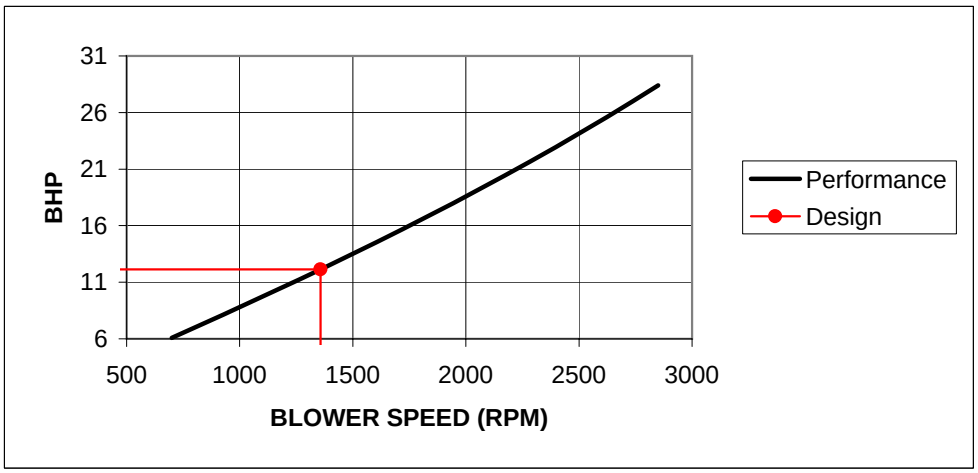


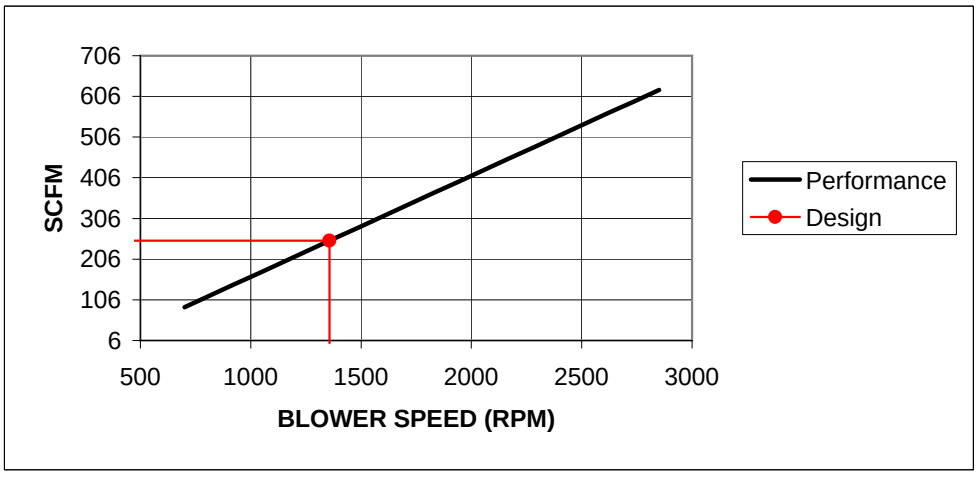
Customer : Intellishare Environmental
Project : 7000 ft

INLET CONDITIONS: AIR
RH = 36.00%, MW = 28.816, k = 1.395, Tin = 68 deg F
DESIGN: Speed = 2379 RPM
System Inlet P = 5.52 in Hg Vac
System Disch P = 11.33 PSIA

Dresser Roots
59 URAI-DSL: Variable Speed Performance







Customer : Intellishare Technologies Inc
Project : 7000 ft - 100 Degrees F

INLET CONDITIONS: AIR
RH = 36.00%, MW = 28.853, k = 1.396, Tin = 68 deg F
DESIGN: Speed = 1357 RPM
System Inlet P = 11.33 PSIA, Inlet P Loss = 0.053 PSI
System Disch P = 6 PSIG

BNPE

ITT

Commercial Water

Goulds Pumps

G&L Series NPE

316L SS

NPE Series End Suction Centrifugal Pumps

Bombas Centrífugas de Succión Final Serie NPE

GOULDS PUMPS

Goulds Pumps is a brand of ITT Corporation.

Goulds Pumps es una marca de fábrica de ITT Corporation.

www.goulds.com

Engineered for life

A Full Range of Product Features
Una Gama Total de Características del Producto

Superior Materials of Construction: Complete AISI 316L stainless steel liquid handling components and mounting bracket for corrosion resistance, quality appearance, and improved strength and ductility.

High Efficiency Impeller: Enclosed impeller with unique floating seal ring design maintains maximum efficiencies over the life of the pump without adjustment.

Casing and Adapter Features: Stainless steel construction with NPT threaded, centerline connections, easily accessible vent, prime and drain connections with stainless steel plugs. Optional seal face vent/flush available.

Mechanical Seal: Standard John Crane Type 21 with carbon versus silicon-carbide faces, Viton elastomers, and 316 stainless metal parts. Optional high temperature and chemical duty seals available.

Motors: NEMA standard open drip-proof, totally enclosed fan cooled or explosion proof enclosures. Rugged ball bearing design for continuous duty under all operating conditions.

Materiales Superiores de Construcción: *Componentes completos para manejo de líquidos en acero inoxidable AISI 316L y consola para el montaje para resistencia a la corrosión, apariencia de calidad, y fuerza y ductilidad mejoradas.*

Impulsor de Eficiencia Superior: *El impulsor encerrado con un diseño único de anillo del sello flotante, mantiene sin ajustes, la eficiencia máxima sobre la vida de la bomba.*

Características de la Carcasa y del Adaptador: *Construcción en acero inoxidable con NPT roscado, conexiones centrales, válvulas de fácil acceso, conexiones de cebado y drenaje con enchufes de acero inoxidable. Cara del sello válvula/chorro opcional disponible.*

Sello Mecánico: *Estándar John Crane Tipo 21 con carbón en contraste con caras de silicón-carbide, elastómeros de Viton, y partes metálicas de acero inoxidable 316. Sellos de alta temperatura y productos químicos están disponibles.*

Motores: *Estándar NEMA a prueba de goteo, ventilador totalmente encerrado o recintos a prueba de explosión. Diseño robusto de balineras de bolas para trabajo continuo en todas las condiciones de funcionamiento.*

NPE Product Line Numbering System
Línea de Producto NPE Sistema de Numeración

Example Product Code,
Ejemplo Código del Producto

1 ST 2 C 1 A 4 F

Seal Vent/Flush Option,
Opción de Sello Válvula/ChorroSeal Ven

Mechanical Seal and O-ring
4 = Pre-engineered standard
For optional mechanical seal modify catalog order no. with seal code listed below.

Sello Mecánico y Anillo 'O'
4 = Estándar aprobado
Para sello mecánico opcional modificar el número de orden del catálogo con el código del sello anotado abajo.

John Crane Type 21 Mechanical Seal (⅝" seal), *Sello Mecánico John Crane Tipo 21 (sello de ⅝")*

Seal Code, *Código del Sello*	Rotary, *Rotativo*	Stationary, *Estacionario*	Elastomers, *Elastómeros*	Metal Parts, *Partes Metálicas*	Part No., *Pieza Número*
2	Carbon	Silicon Carbide	EPR	316 SS	10K18
4			Viton		10K55
5	Silicon Carbide		EPR		10K81
6			Viton		10K62

Impeller Option . . . No Adder Required
For optional impeller diameters modify catalog order no. with impeller code listed. Select optional impeller diameter from pump performance curve.

Código del Impulsor Opcional
Para impulsores con diámetros opcionales modificar el número de orden del catálogo con el código del impulsor anotado. Escoger el impul con diámetro opcional de la curva de funcionamiento de la bomba.

Impeller Code, *Código del Impulsor*	Pump Size, *Tamaño de la Bomba*		
	1 x 1¼ – 6	1¼ x 1½ – 6	1½ x 2 – 6
	Diameter	Diameter	Diameter
K	–	6⅛	–
G	–	5 15/16	5⅜
H	–	5½	5
A	6⅛	5¼	4¾
B	5¾	5 1/16	4⅝
C	5 3/16	4⅞	4⅜
D	4¾	4⅝	4 1/16
E	4 7/16	4¼	3⅝
F	4 1/16	3⅞	–

Driver, *Conductor*
1 = 1 PH, ODP
2 = 3 PH, ODP
3 = 575 V, ODP
4 = 1 PH, TEFC
5 = 3 PH, TEFC
6 = 575 V, TEFC
7 = 3 PH, XP
8 = 575 V, XP
9 = 3 PH, TEFC Premium Eff.
0 = 1 PH, XP

HP Rating, *HP Potencia*
C = ½ HP E = 1 HP G = 2 HP J = 5 HP
D = ¾ HP F = 1½ HP H = 3 HP

Driver: Hertz/Pole/RPM, *Conductor: Hercios/Polo/RPM*
1 = 60 Hz, 2 pole, 3500 RPM
2 = 60 Hz, 4 pole, 1750 RPM
3 = 60 Hz, 6 pole, 1150 RPM
4 = 50 Hz, 2 pole, 2900 RPM
5 = 50 Hz, 4 pole, 1450 RPM

For frame mounted version, substitute the letters "FRM" in these positions.
Para la versión con el armazón montado, sustituya las letras "FRM" en estas posiciones.

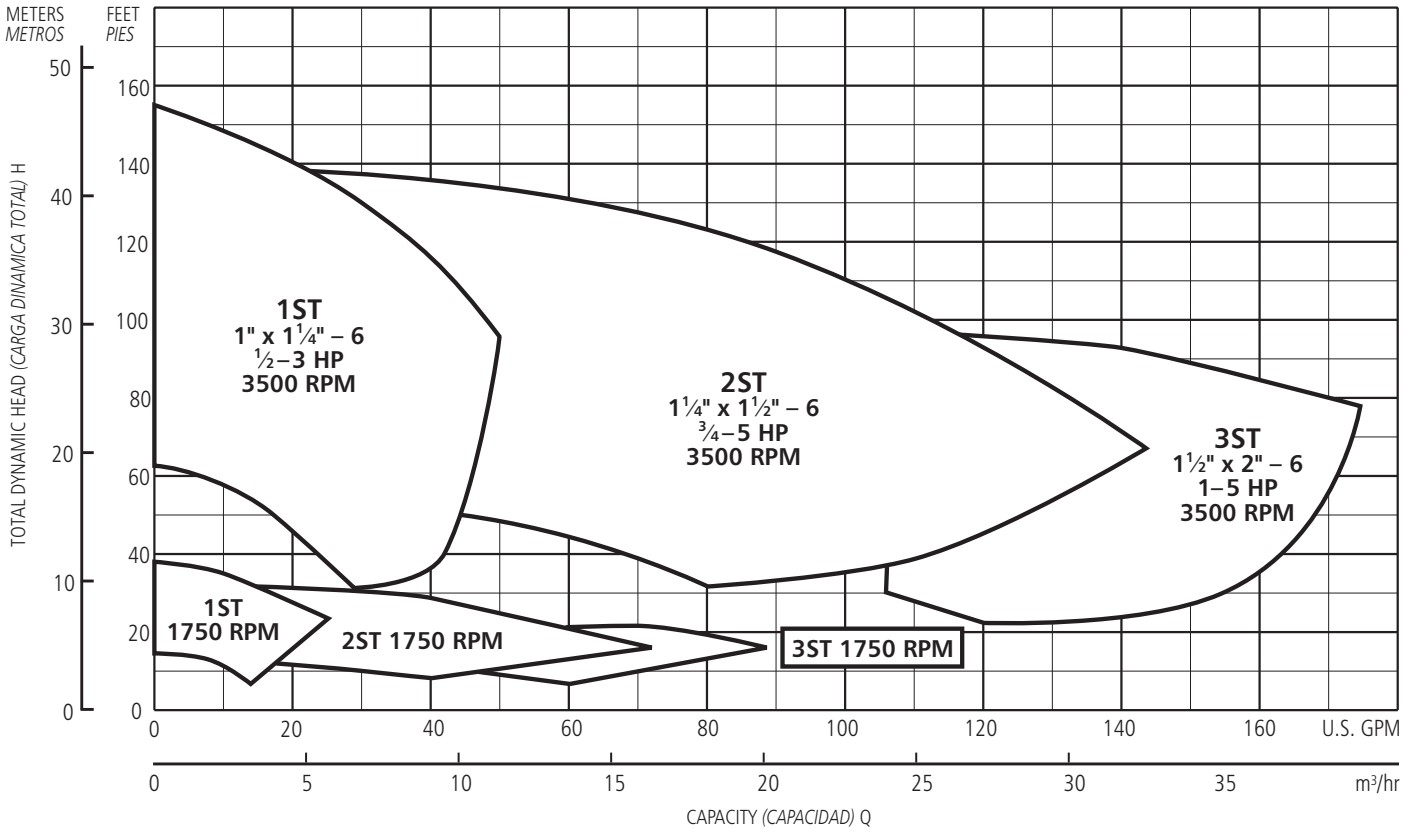
Material
ST = Stainless steel, *Acero inoxidable*

Pump Size, *Tamaño de la Bomba*
1 = 1 x 1¼ – 6 2 = 1¼ x 1½ – 6 3 = 1½ x 2 – 6

The various versions of the NPE are identified by a product code number on the pump label. This number is also the catalog number for the pump. The meaning of each digit in the product code number is shown at left.

Las diferentes versiones de la NPE se identifican con un número de código del producto en la etiqueta de la bomba. Este número es también el número del catálogo para la bomba. El significado de cada dígito en el número de código del producto se muestra a la izquierda.

Performance Coverage (60 Hz)
Alcance de Funcionamiento (60 Hz)



NOTES:

Not recommended for operation beyond printed H-Q curve.

For critical application conditions consult factory.

Not all combinations of motor, impeller and seal options are available for every pump model. Please check with G&L on non-cataloged numbers.

All standard 3500 RPM ODP and TEFC motors supplied by Goulds Pumps, have minimum of 1.15 service factor. Standard catalog units may utilize available service factor. Any motors supplied other than Goulds Pumps check available service factor.

NOTAS:

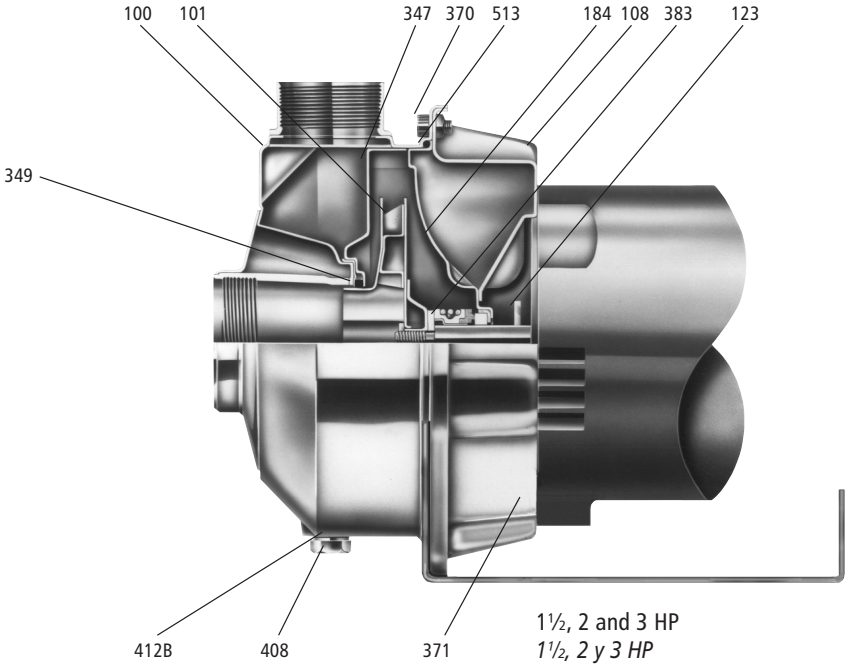
No se recomienda para funcionamiento superior al impreso en la curva H-Q.

Para condiciones de aplicaciones críticas consultar con la fábrica.

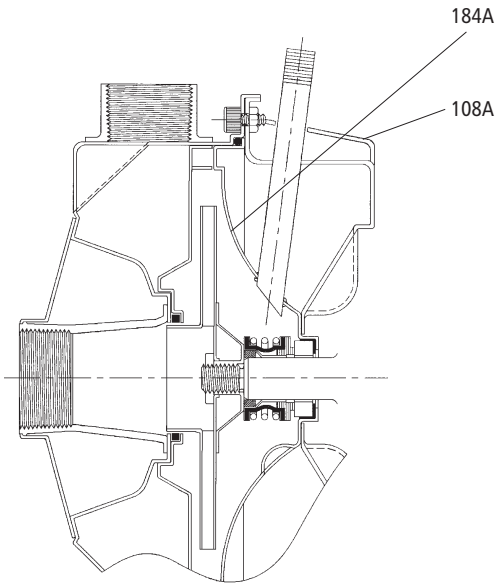
No todas las combinaciones de las opciones de motor, impulsor y sello están disponibles para cada modelo de bombas. Por favor verifique con G&L en los números no catalogados.

Todos los motores estándar de 3500 RPM, ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado) provistos por Goulds Pumps tienen un factor mínimo de servicio de 1,15. Las unidades estándar de catálogo pueden utilizar el factor de servicio disponible. Verificar el factor de servicio disponible de todo motor no provisto por Goulds Pumps.

NPE Close Coupled Pump Major Components: Materials of Construction
Bomba Cerrada Acoplada NPE Componentes Principales: Materiales de Construcción

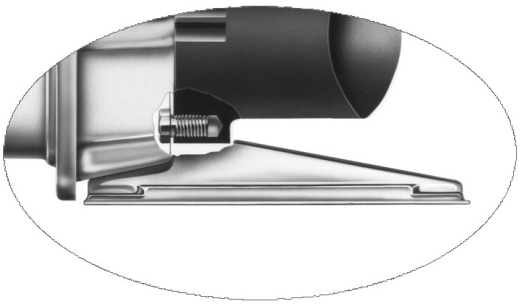


1½, 2 and 3 HP
1½, 2 y 3 HP



Seal Face Vent/Flush Option,
Opción Cara del Sello Válvula/Chorro

Item No., *Parte No.*	Description, *Descripción*	Materials, *Materiales*
100	Casing; *Carcasa*	AISI 316L SS; *AISI 316L Acero inoxidable*
101	Impeller; *Impulsor*	
108	Motor adapter; *Adaptador del motor*	
108A	Motor adapter seal vent/flush; *Sello válvula/chorro del adaptador del motor*	
123	Deflector; *Deflector*	BUNA-N
184	Seal housing; *Alojamiento del sello*	AISI 316L SS; *AISI 316L Acero inoxidable*
184 A	Seal housing seal vent/flush; *Sello válvula/chorro del alojamiento del sello*	
347	Guidevane; *Difusor*	
349	Seal ring, guidevane; *Anillo del sello, difusor*	Viton
370	Socket head screws, casing; *Encajes cabezas de tornillos, carcasa*	AISI 410 SS; *AISI 410 Acero inoxidable*
371	Bolts, motor; *Tornillos, motor*	Plated steel; Acero chapeado
383	Mechanical seal; *Sello mecánico*	**see chart, *ver tabla*
408	Drain and vent plug, casing; *Enchufes de drenaje y válvula, carcasa*	AISI 316L SS; *AISI 316L Acero inoxidable*
412B	O-ring, drain and vent plug; *Anillo 'O', enchufe de drenaje y válvula*	Viton (Standard, *estándar*) EPR (Optional, *Opcional*)
513	O-ring, casing; *Anillo 'O', carcasa*	
Motor *Motor*	NEMA standard, 56J flange; *NEMA estándar, brida 56J*	

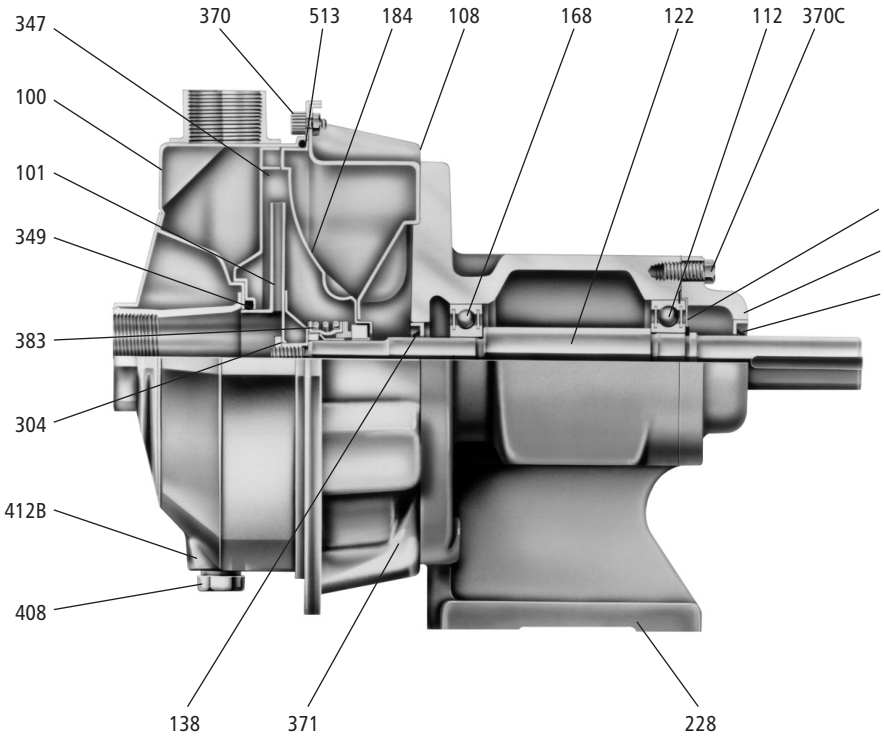


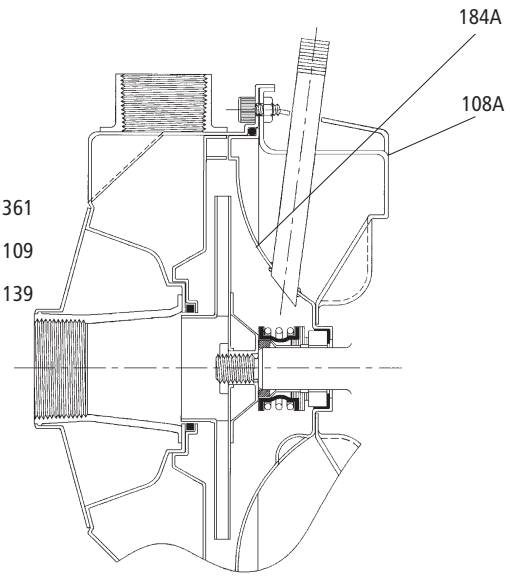
½, ¾ and 1 HP
½, ¾ y 1 HP

Footed motor for 5 HP ODP and TEFC, all explosion proof motors, see page 13.

Motor con pie para 5 HP ODP y TEFC, a prueba de explosiones motores, en la página 13.

NPE Frame Mounted Pump Major Components: Materials of Construction
Bomba NPE de Armazón Montado Componentes Principales: Materiales de Construcción



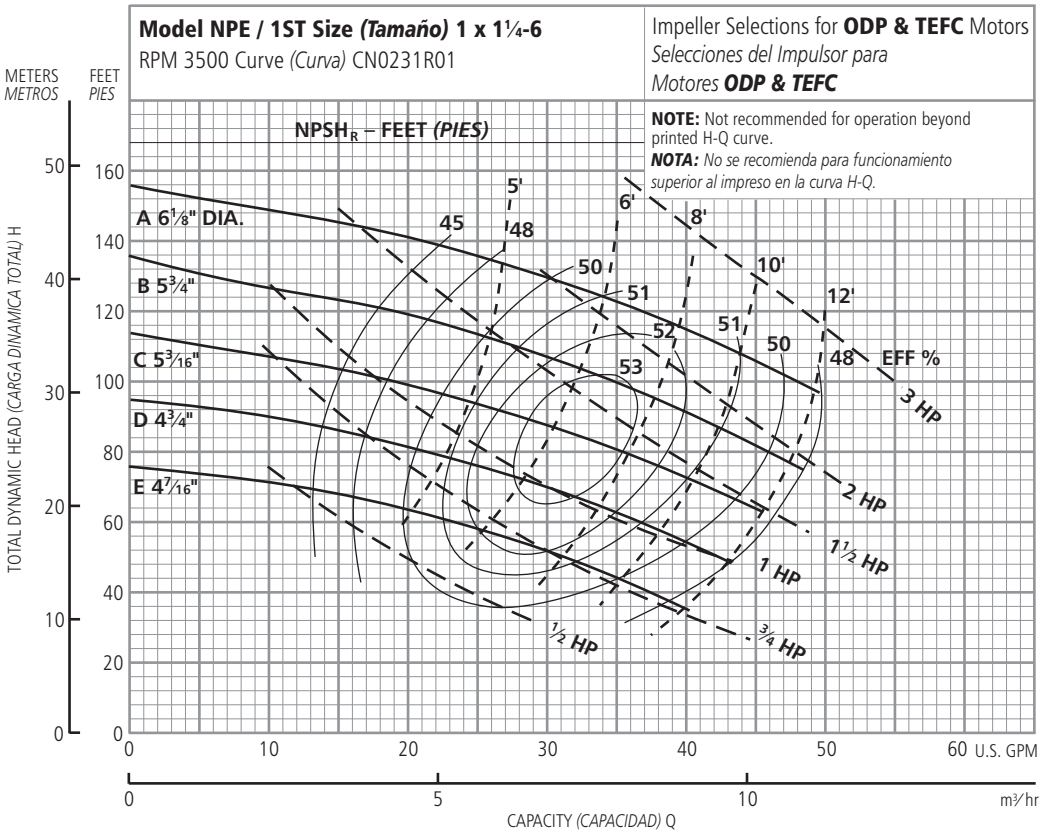


Seal Face Vent/Flush Option,
Opción Cara del Sello Válvula/Chorro

Item No., *Parte No.*	Description, *Descripción*	Materials, *Materiales*
100	Casing; *Carcasa*	AISI 316L SS; *AISI 316L Acero inoxidable*
101	Impeller; *Impulsor*	
108	Adapter; *Adaptador*	
108A	Motor adapter seal vent/flush; *Sello válvula/chorro del adaptador del motor*	
109	Bearing cover; *Cubierta de balineras*	Cast iron; *Hierro fundido*
112	Ball bearing (outboard); *Balineras de bolas (exterior)*	Steel; *Acero*
122	Shaft; *Eje*	AISI 316 SS; *AISI 316 Acero inoxidable*
138	Lip-seal (inboard); *Sello cubierto (interior)*	BUNA/steel; *BUNA/acero*
139	Lip-seal (outboard); *Sello cubierto (exterior)*	BUNA/steel; *BUNA/acero*
168	Ball bearing (inboard); *Balineras de bolas (interior)*	Steel; *Acero*
184	Seal housing; *Alojamiento del sello*	AISI 316L SS; *AISI 316L Acero inoxidable*
184 A	Seal housing seal vent/flush; *Sello válvula/chorro del alojamiento del sello*	
228	Bearing frame; *Armazón de balineras*	Cast iron, *Hierro fundido*

Item No., *Parte No.*	Description, *Descripción*	Materials, *Materiales*
304	Impeller locknut; *Contratuerca del impulsor*	AISI 316 SS; *AISI 316 Acero inoxidable*
347	Guidevane; *Difusor*	
349	Seal ring, guidevane; *Anillo del sello, difusor*	Viton
361	Retaining ring; *Anillo de retención*	Steel; Acero
370	Socket head screws, casing; *Encaje cabeza del tornillo, carcasa*	AISI 410 SS; *AISI 410 Acero inoxidable*
370C	Hex head screw, bearing cover; *Tornillo de cabeza hexagonal, cubierta de balineras*	Plated steel; *Acero chapeado*
371	Hex head screw, bearing frame; *Tornillo de cabeza hexagonal, armazón de balineras*	Plated steel; *Acero chapeado*
383	Mechanical seal; *Sello mecánico*	**see chart; ver tabla
400	Shaft key; *Llave del eje*	Steel; Acero
408	Drain and vent plug, casing; *Enchufes de drenaje y válvula, carcasa*	AISI 316 SS; *AISI 316 Acero inoxidable*
412B	O-ring, drain and vent plug; *Anillo 'O', enchufe de drenaje y válvula*	Viton (Standard, *estándar*) EPR (Optional, *Opcional*)
513	O-ring, casing; *Anillo 'O', carcasa*	

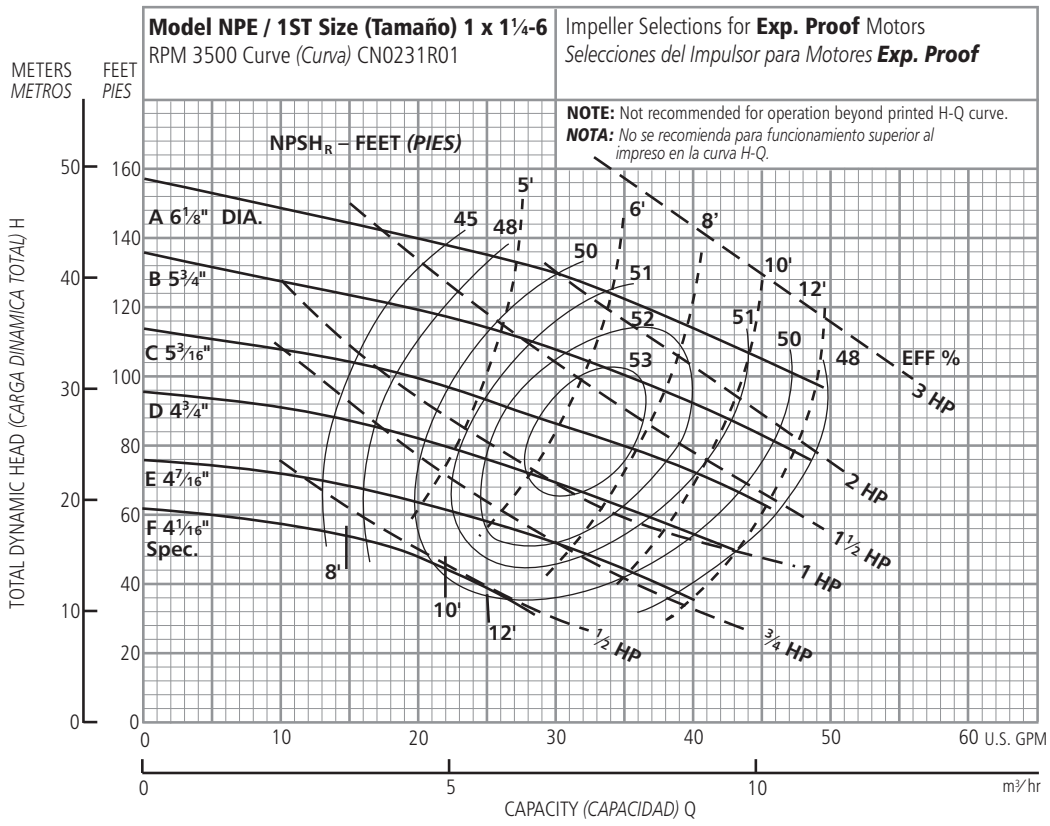
Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
E	½	4 7/16"
D	¾	4¾
C	1	5 3/16
B	1½	5¾
A	2	6⅛

NOTE: Although not recommended, the pump may pass a 1/16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 1/16".*

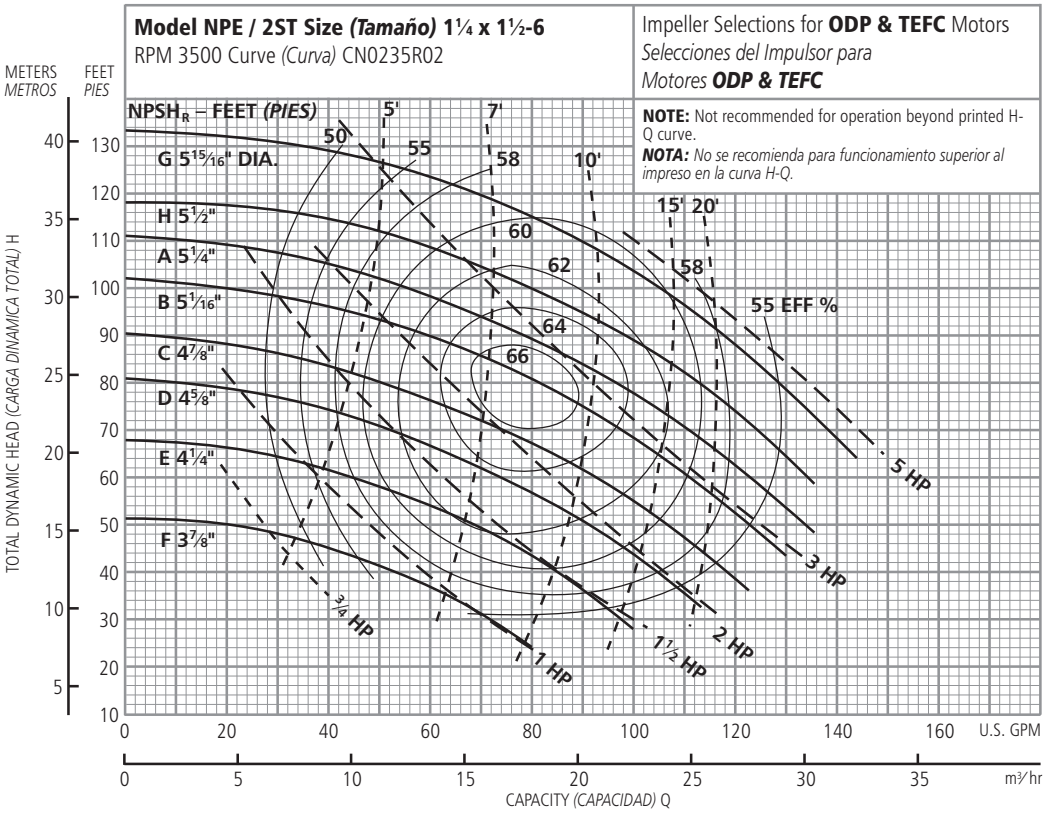


Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	½	4 1/16" spec.
E	¾	4 7/16
D	1	4¾
C	1½	5 3/16
B	2	5¾
A	3	6⅛

NOTE: Although not recommended, the pump may pass a 1/16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 1/16".*

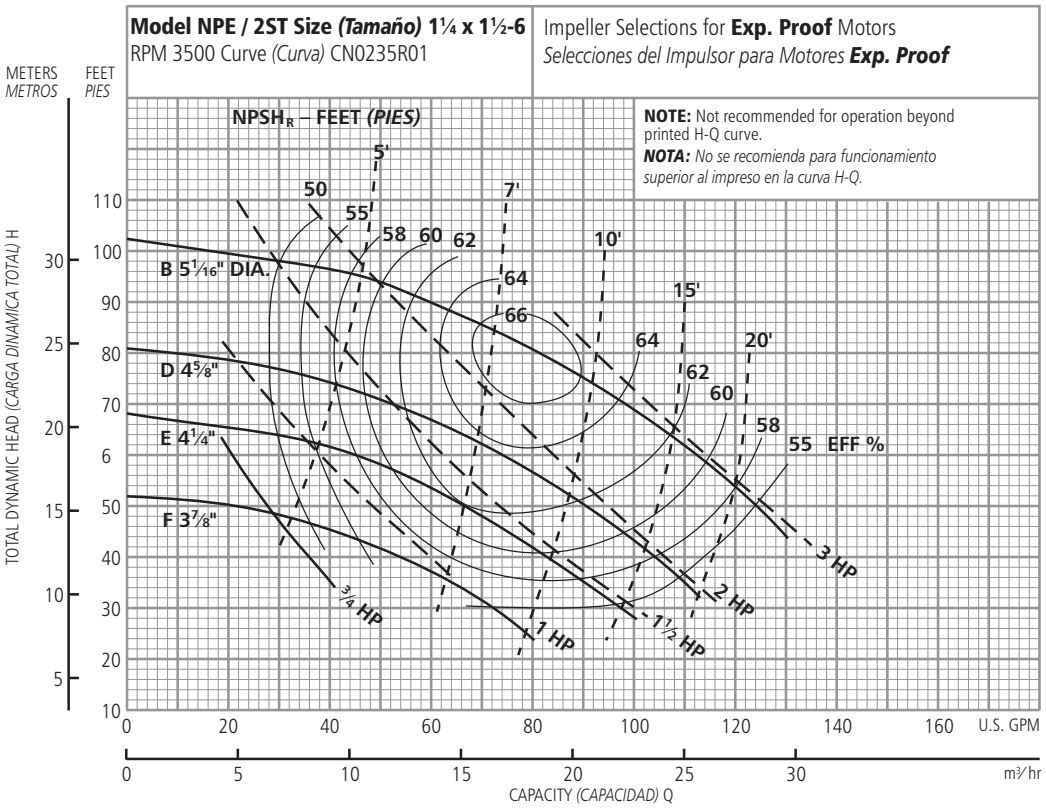
Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	¾	3 7/8"
E	1	4¼
D	1½	4⅝
C	2	4⅞
B	3	5 1/16
A	3	5¼
H	5	5½
G	5	5 15/16

NOTE: Although not recommended, the pump may pass a 3/16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 3/16".*

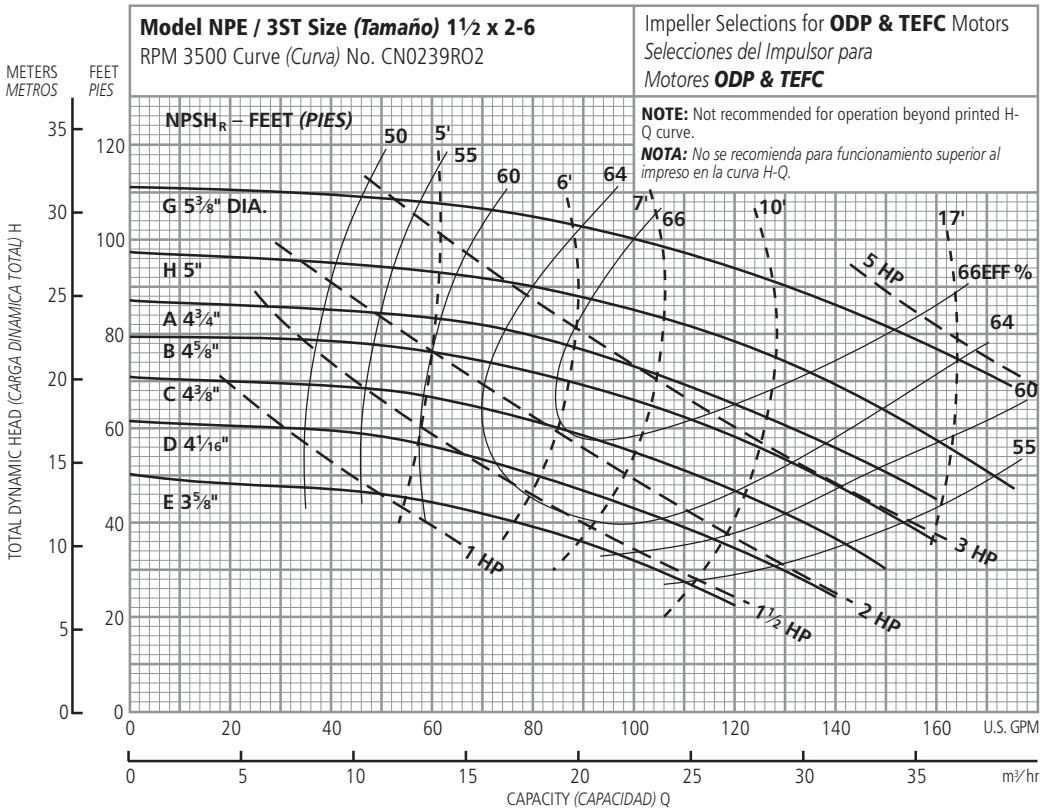


Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
F	1	3 7/8"
E	1½	4¼
D	2	4⅝
B	3	5 1/16

NOTE: Although not recommended, the pump may pass a 3/16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 3/16".*

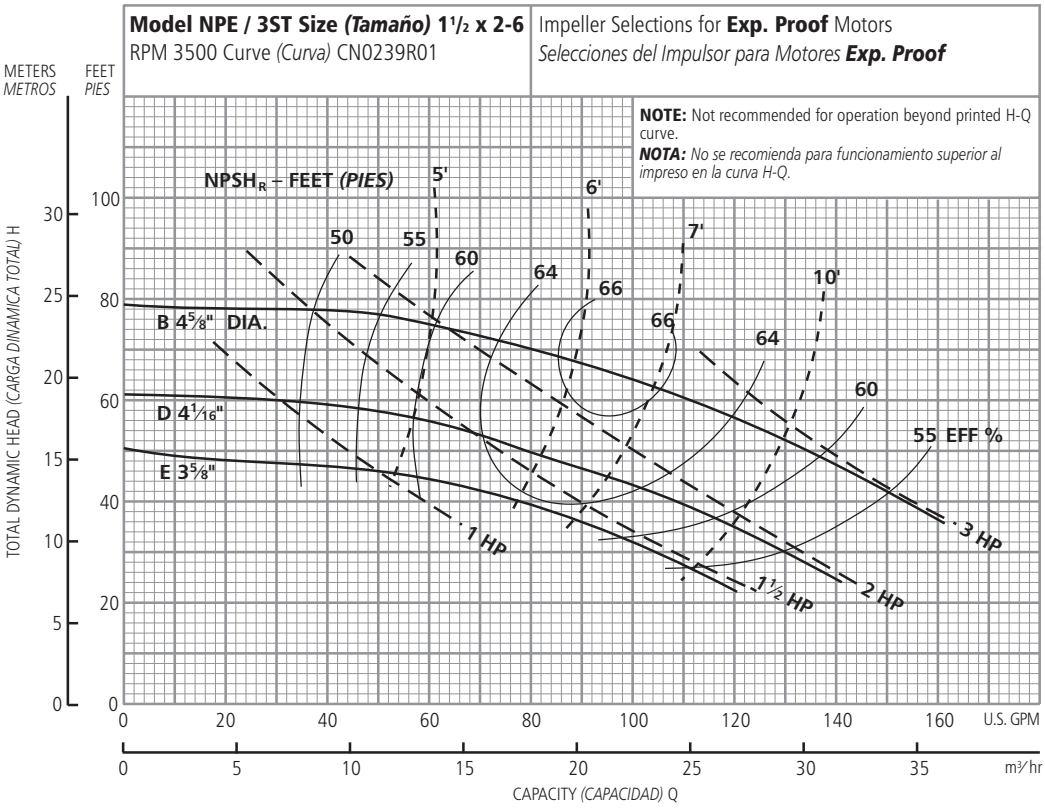
Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
E	1	3⅝"
D	1½	4¹⁄₁₆
C	2	4⅜
B	3	4⅝
A	3	4¾
H	5	5
G	5	5⅜

NOTE: Although not recommended, the pump may pass a 11⁄32" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 11⁄32".*

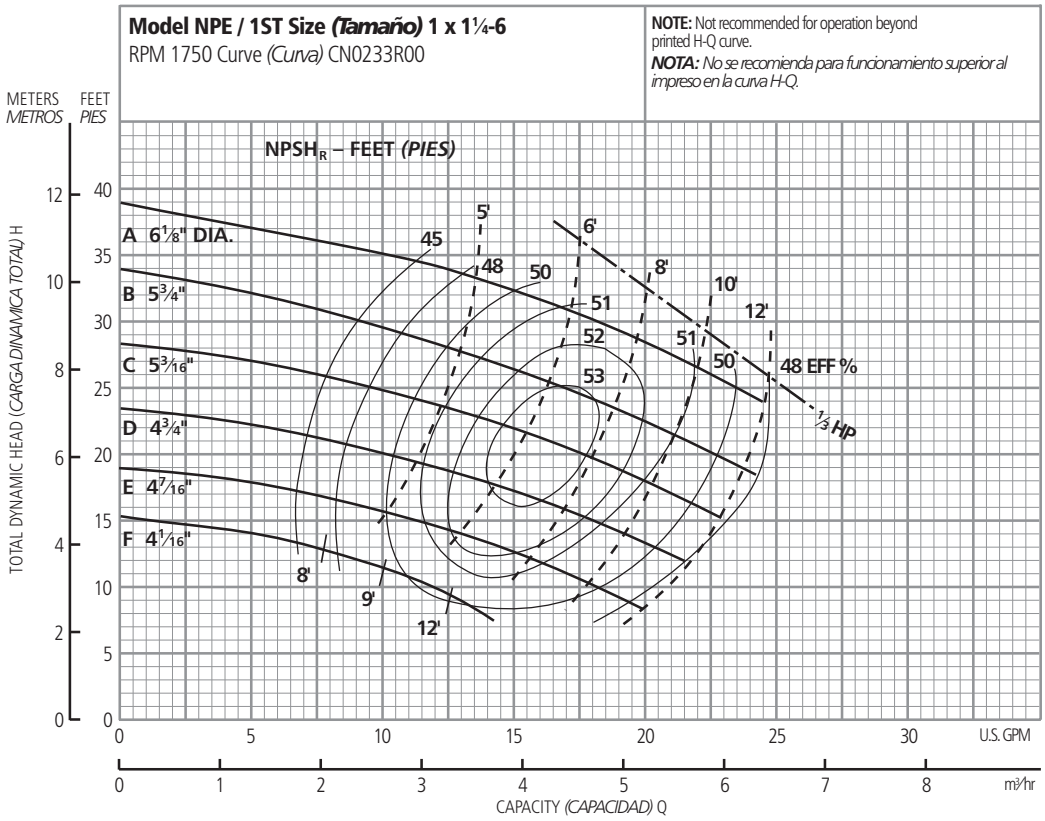


Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
E	1½	3⅝"
D	2	4¹⁄₁₆
B	3	4⅝

NOTE: Although not recommended, the pump may pass a 11⁄32" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 11⁄32".*

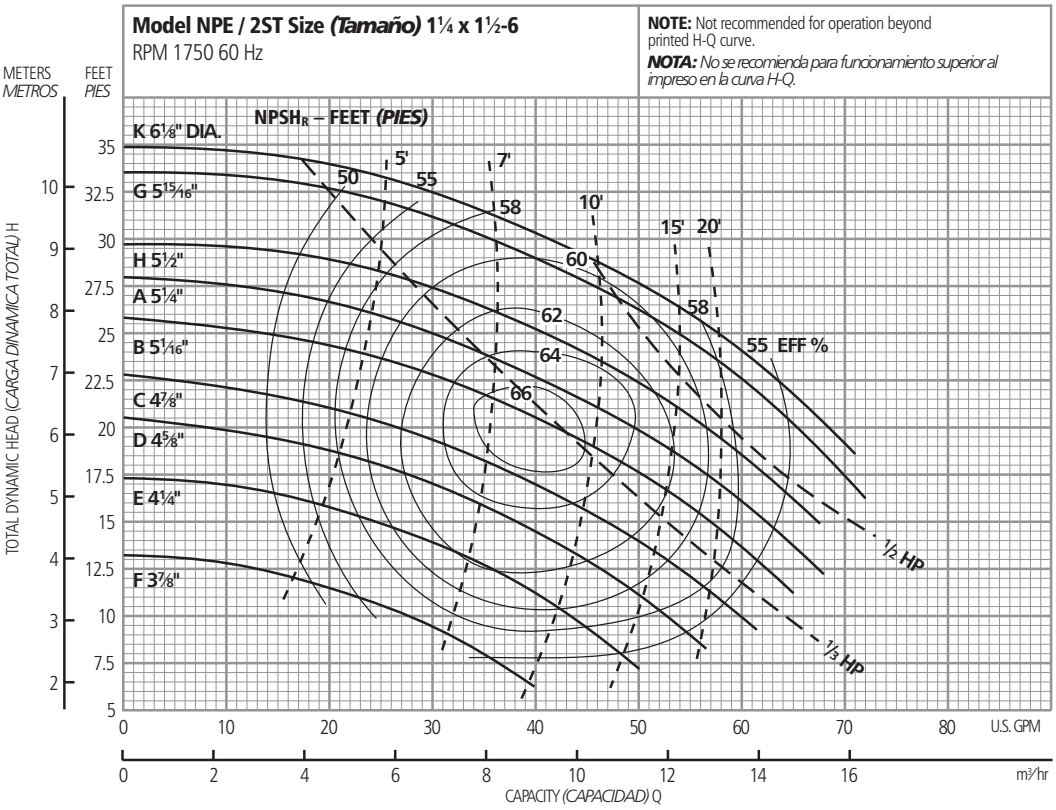
Performance Curves – 60 Hz, 1750 RPM
Curvas de Funcionamiento – 60 Hz, 1750 RPM



Optional Impeller, *Impulsor Opcional*	
Ordering Code, *Código de Pedido*	**Dia.**
A	6⅛"
B	5¾
C	5³⁄₁₆
D	4¾
E	4⁷⁄₁₆
F	4¹⁄₁₆

NOTE: Although not recommended, the pump may pass a ¹⁄₁₆" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de ¹⁄₁₆".*

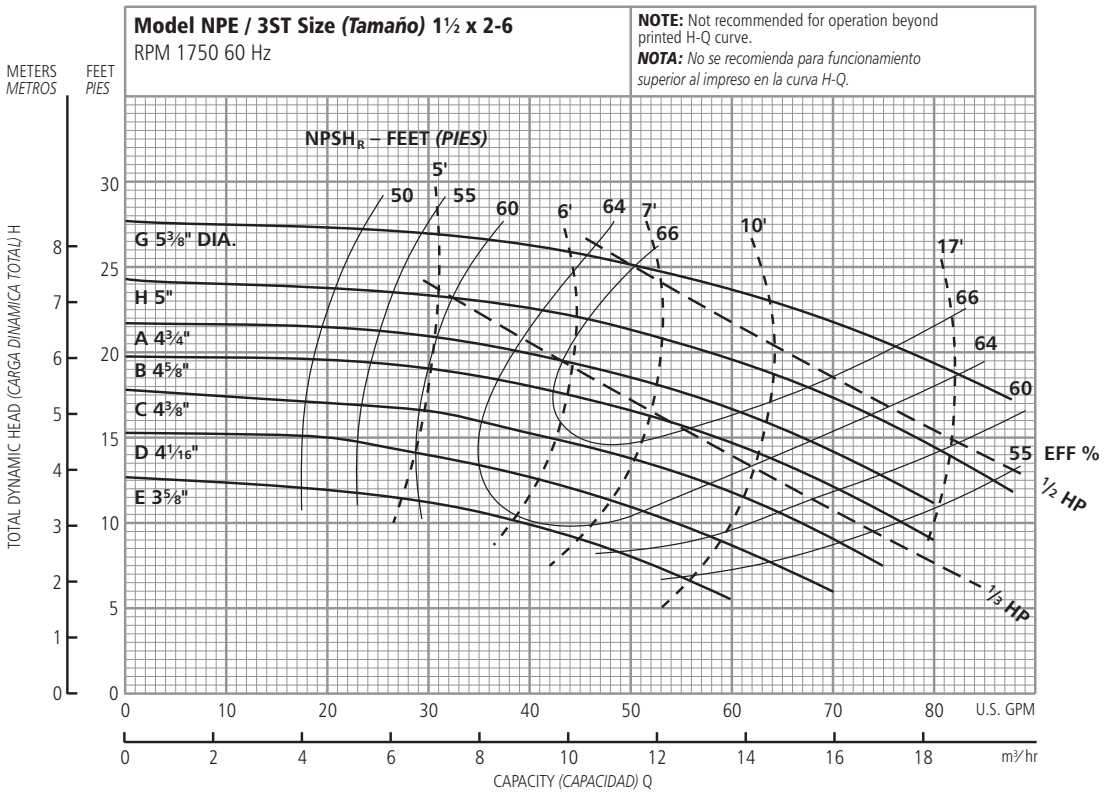


Optional Impeller, *Impulsor Opcional*	
Ordering Code, *Código de Pedido*	**Dia.**
K	6⅛"
G	5¹⁵⁄₁₆"
H	5½
A	5¼
B	5¹⁄₁₆
C	4⅞
D	4⅝
E	4¼
F	3⅞

NOTE: Although not recommended, the pump may pass a ³⁄₁₆" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de ³⁄₁₆".*

Performance Curves – 60 Hz, 1750 RPM
Curvas de Funcionamiento – 60 Hz, 1750 RPM

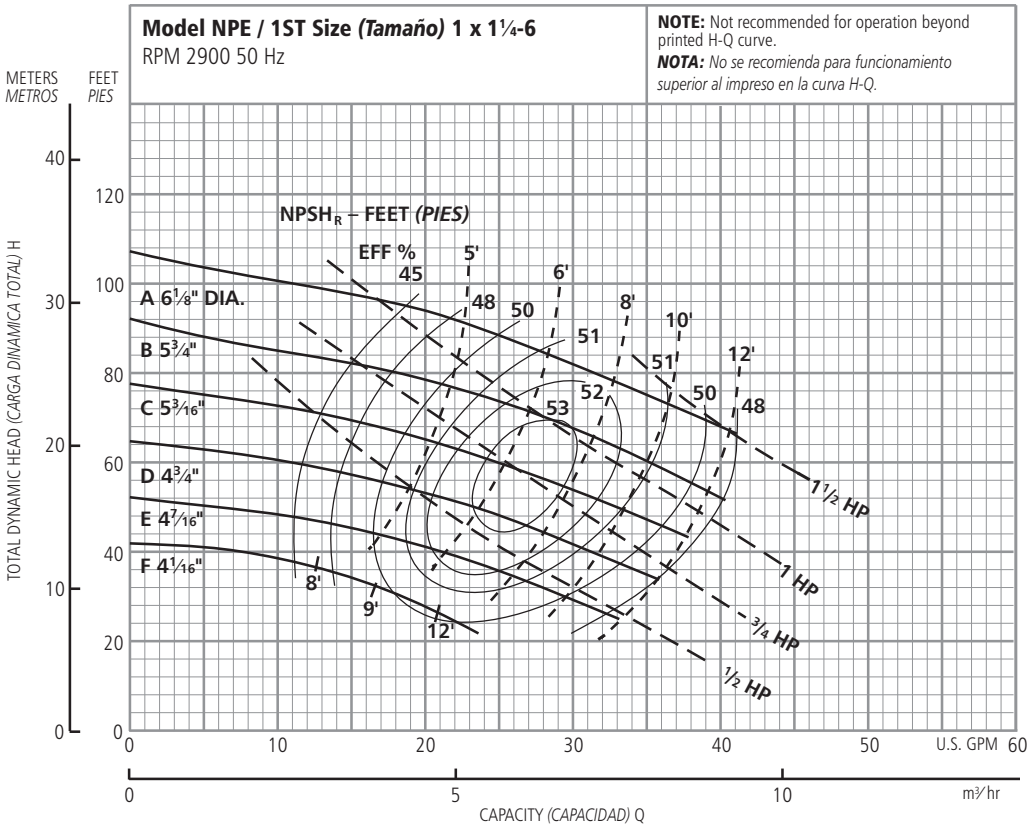


Optional Impeller, *Impulsor Opcional*	
Ordering Code, *Código de Pedido*	**Dia.**
G	5⅜"
H	5
A	4¾
B	4⅝
C	4⅜
D	4 1/16
E	3⅝

NOTE: Although not recommended, the pump may pass a 11/32" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 11/32".*

Performance Curves – 50 Hz, 2900 RPM
Curvas de Funcionamiento – 50 Hz, 2900 RPM

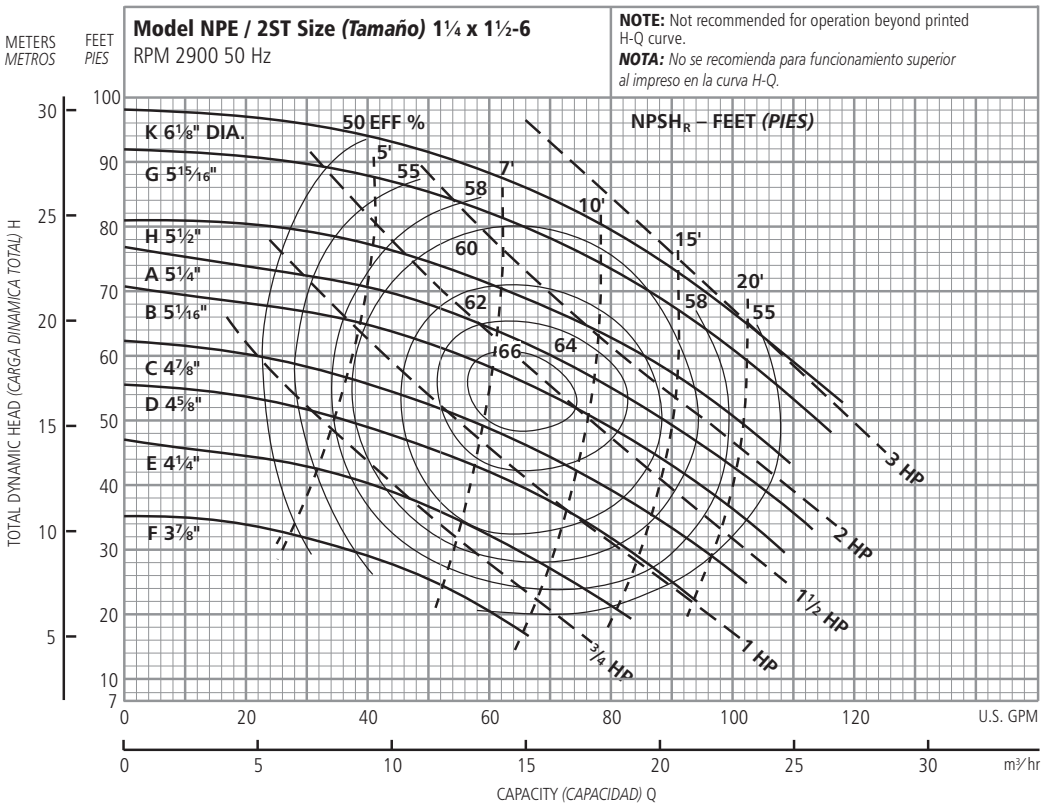


Optional Impeller, *Impulsor Opcional*	
Ordering Code, *Código de Pedido*	**Dia.**
A	6 1/8"
B	5¾
C	5 3/16
D	4¾
E	4 7/16
F	4 1/16

NOTE: Although not recommended, the pump may pass a 1/16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 1/16".*

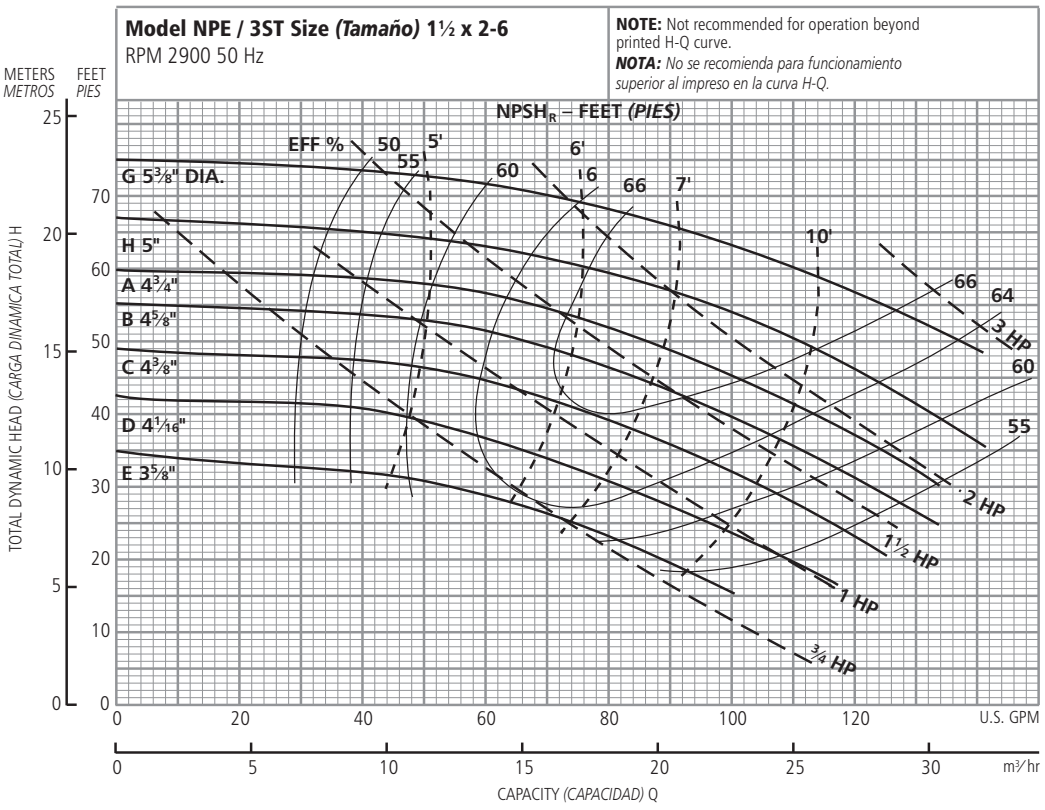
Performance Curves – 50 Hz, 2900 RPM
Curvas de Funcionamiento – 50 Hz, 2900 RPM



Optional Impeller, *Impulsor Opcional*	
Ordering Code, *Código de Pedido*	**Dia.**
K	6⅛"
G	5¹⁵⁄₁₆"
H	5½
A	5¼
B	5¹⁄₁₆
C	4⅞
D	4⅝
E	4¼
F	3⅞

NOTE: Although not recommended, the pump may pass a 3⁄16" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 3⁄16".*



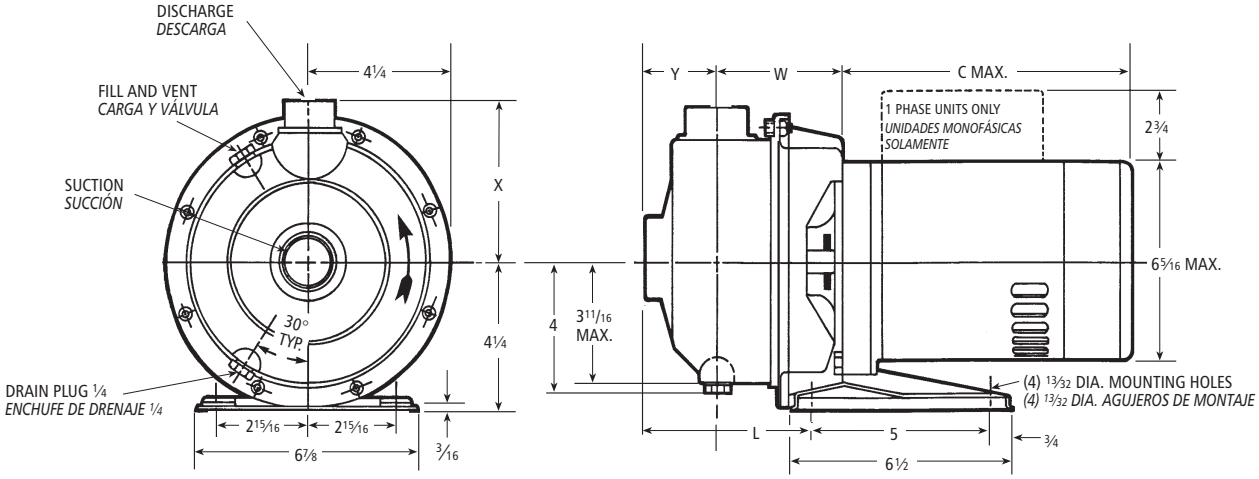
Optional Impeller, *Impulsor Opcional*	
Ordering Code, *Código de Pedido*	**Dia.**
G	5⅜"
H	5
A	4¾
B	4⅝
C	4⅜
D	4¹⁄₁₆
E	3⅝

NOTE: Although not recommended, the pump may pass a 11⁄32" sphere.

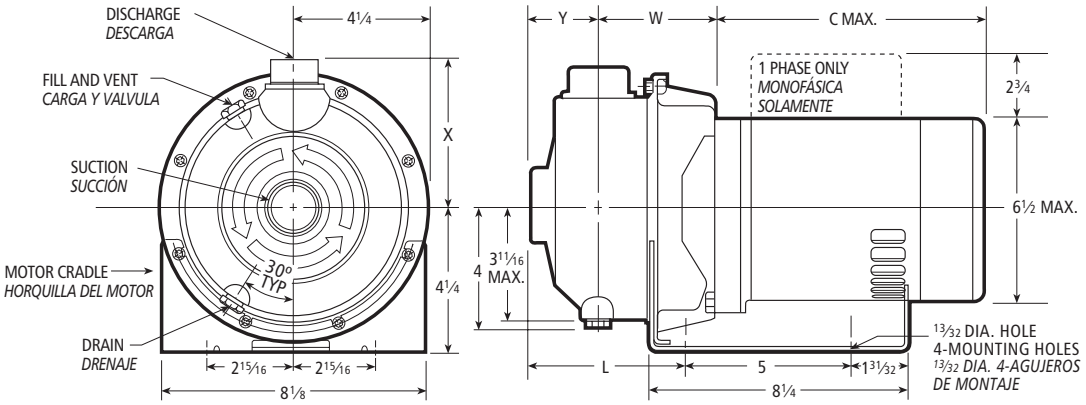
NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de 11⁄32".*

NPE Close Coupled – Dimensions, Weights and Specifications
NPE Acople Cerrado – Dimensiones, Pesos y Especificaciones

Clockwise Rotation Viewed from Drive End
Rotación en Dirección de las Agujas del Reloj Visto desde el Extremo del Motor



ODP and TEFC ½, ¾ and 1 HP (standard), *ODP y TEFC ½, ¾ y 1 HP (estándar)*



ODP and TEFC 1½, 2 and 3 HP (standard), *ODP y TEFC 1½, 2 y 3 HP (estándar)*

Specifications
Especificaciones

Capacities to:
85 GPM (322L/min) at 1750 RPM
170 GPM (643L/min) at 3500 RPM

Heads to:
39 feet (12 m) at 1750 RPM
150 feet (46 m) at 3500 RPM

Working pressures to:
125 PSIG (9 bars)

Maximum temperatures to:
250° F (121° C)

Direction of rotation:
Clockwise when viewed from motor end.

Motor specifications:
NEMA 56J frame, 1750 RPM, ½ HP. 3500 RPM ½ through 5 HP. Open drip-proof, totally enclosed fan-cooled or explosion proof enclosures. Stainless steel shaft with ball bearings.

Single phase: Voltage 115/230 ODP and TEFC. (3 and 5 HP model – 230 V only) Built-in overload with auto-reset provided.

Three phase: Voltage 208-230/460 ODP, TEFC and EX PROOF.

NOTE: For three phase motors, overload protection must be provided in starter unit. Starter and heaters must be ordered separately.

Capacidades:
85 GPM (322L/min) a 1750 RPM
170 GPM (643L/min) a 3500 RPM

Cargas:
39 pies (12 m) a 1750 RPM
150 pies (46 m) a 3500 RPM

Presión de trabajo:
125 PSIG (9 baras)

Temperatura máxima:
250° F (121° C)

Dirección de rotación:
En dirección de las agujas del reloj visto desde el extremo final del motor.

Motores:
Armazón 56J NEMA, 1750 RPM ½ HP. 3500 RPM ½ a 5 HP. Cubiertas abiertas resguardadas, totalmente encerradas enfriadas por ventilador o a prueba de explosiones. Eje de acero inoxidable con balineras de bolas.

Monofásicos: *Voltaje 115/230 ODP y TEFC. (modelo 3 y 5 HP – 230 voltios solamente) Se proporciona protección térmica contra sobrecarga construida con reseteo automático.*

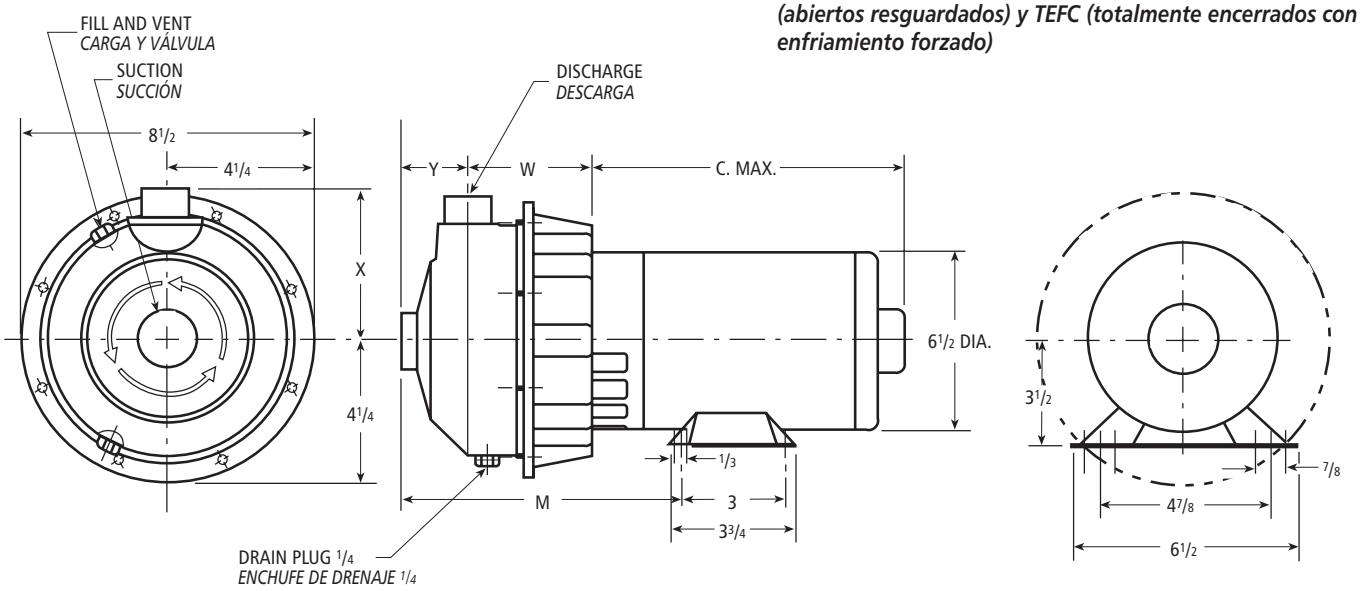
Trifásicos: *Voltaje 208-230/460 ODP, TEFC y EX PROOF.*

NOTA: *Para motores trifásicos se debe de proporcionar la protección térmica contra sobrecarga en la unidad de arranque. El arrancador y los calentadores se deben pedir por separado.*

NPE Close Coupled with Footed Motor, Explosion-proof and 5 HP Motors
NPE Acople Cerrado con Motor con Patas, Motores a Prueba de Explosión Y 5 HP

All Explosion Proof Motors and 5 HP ODP and TEFC

Todos los motores son a prueba de explosiones, 5 HP, ODP (abiertos resguardados) y TEFC (totalmente encerrados con enfriamiento forzado)



Dimensions – Determined by Pump, *Dimensiones – Determinadas por la Bomba*

Pump, *Bomba*	Suction, *Succión*	Discharge, *Descarga*	HP	W	X	Y	L	M
1ST	1¼	1	½ – 3	3 5/16	4⅜	2	4 9/16	7 5/16
2ST	1½	1¼	¾ – 5	3¾	4½	2⅛	5⅛	7⅞
3ST	2	1½	1 – 5	3¾	4⅝	2⅛	5⅛	7⅞

Available Motor Weights and Dimensions, *Pesos y Dimensiones Disponibles del Motor*

HP	Motor Weights, *Pesos del Motor*						C Max. Length, *(Longitud)*
	1 Phase, *Monofásicos*			3 Phase, *Trifásicos*			
	ODP	TEFC	EXP	ODP	TEFC	EXP	
½	16	21	47	19	18	27	9 15/16
¾	19	24	41	21	21	30	10¼
1	22	26	49	23	21	30	11
1½	28	35	56	27	27	37	11 5/16
2	33	39	60	32	33	44	12 1/16
3	40	43	—	41	37	—	12 7/16
5	42	—	—	42	45	—	14¼

Dimensions in inches, weights in pounds.
Dimensiones en pulgadas, pesos en libras.

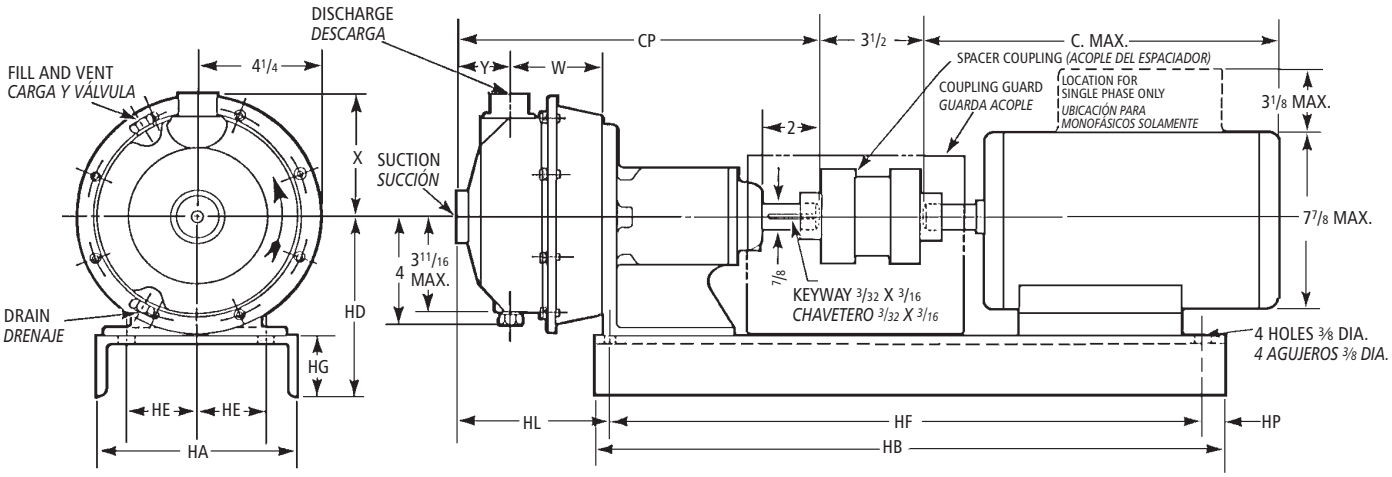
NOTES:

1. Pump will be shipped with top vertical discharge position as standard. For other orientations, remove casing bolts, rotate discharge to desired position, replace and tighten 6mm bolts to 5 – 6 lbs.-ft.
2. Motor dimensions may vary with motor manufacturers.
3. Dimensions in inches, weights in pounds.
4. For explosion proof motor dimensions consult factory for information.
5. Not to be used for construction purposes unless certified.

NOTAS:

1. *Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y reemplazar y apretar los tornillos de 6mm a 5 – 6 libras-pies.*
2. *Las dimensiones del motor puede que varíen con los fabricantes.*
3. *Dimensiones en pulgadas, pesos en libras.*
4. *Para las dimensiones de los motores a prueba de explosión consultar con la fábrica para información.*
5. *No usar para propósitos de construcción sin certificar.*

NPE Frame Mounted – Dimensions, Weights and Specifications
NPE Armazón Montado – Dimensiones, Pesos y Especificaciones



Specifications
Especificaciones

Capacities to:
85 GPM (322L/min) at 1750 RPM
170 GPM (643L/min) at 3500 RPM

Heads to:
39 feet (12 m) at 1750 RPM
150 feet (47 m) at 3500 RPM

Working pressures to:
125 PSIG (9 bars)

Maximum temperatures to:
250°F (121°C)

Direction of rotation:
Clockwise when viewed from motor end.

Motor specifications:
T-frame single and three phase. Open drip-proof, TEFC or explosion proof enclosures are available for 60 Hz, 3500 and 1750 RPM operation.

For three phase motors, overload protection must be provided in starter unit. Starter and heaters must be ordered separately.

Capacidades:
85 GPM (322L/min) a 1750 RPM
170 GPM (643L/min) a 3500 RPM

Cargas:
39 pies (12 m) a 1750 RPM
150 pies (47 m) a 3500 RPM

Presión de trabajo:
125 PSIG (9 baras)

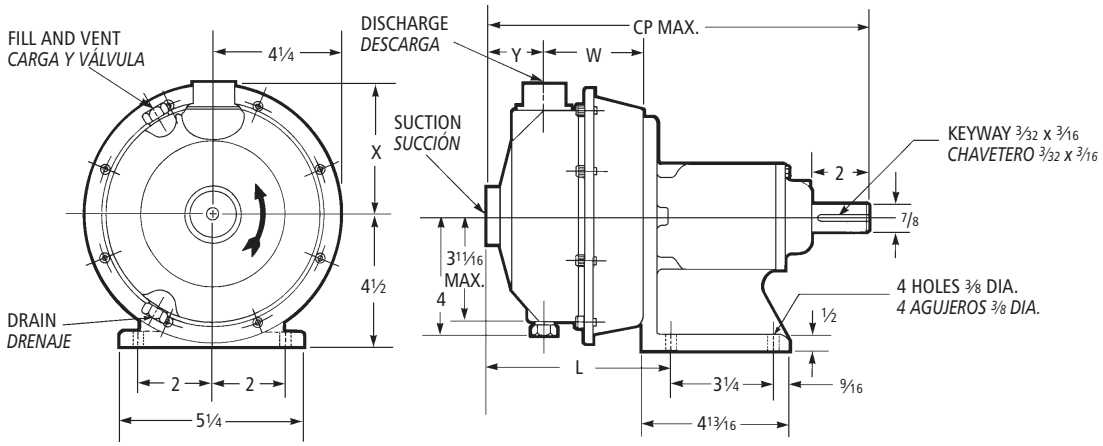
Temperatura máxima:
250°F (121°C)

Dirección de rotación:
En dirección de las agujas del reloj visto desde el extremo final del motor.

Motores:
Armazón T- monofásico y trifásico. A prueba de goteo, TEFC o recintos a prueba de explosión están disponibles para funcionamiento de 60 Hz, 3500 y 1750 RPM.

Para motores trifásicos se debe de proporcionar la protección térmica contra sobrecarga en la unidad de arranque. El arrancador y los calentadores se deben pedir por separado.

NPE-F



Dimensions and Weights – Determined by Pump,
Dimensiones y Pesos – Determinados por la Bomba

Pump, *Bomba*	Suct. NPT, *Succión NPT*	Disch. NPT, *Descarga NPT*	CP	L	W	X	Y	Wt., *Peso*	Dim. "HL" Determined by Pump and Motor, *Dim. "HL" Determinadas por la Bomba y el Motor* Frame, *Armazón* 56	140	180
1ST	1 1/4	1	12 15/16	6 7/16	3 5/16	4 3/8	2	22 1/2	4 9/16		6 7/16
2ST	1 1/2	1 1/4	13 1/2	7	3 3/4	4 1/2	2 1/8	23	5 1/8		7
3ST	2	1 1/2				4 5/8					

Available Motor and Bedplate Dimensions and Weights,
Pesos y Dimensiones Disponibles de la Fundación y del Motor

Motor Frame, *Armazón del Motor*	HA	HB	HD	HE	HF	HG	HP	Wt. Max., *Peso Máx*	Shims, *Deflector*
56 143T 145T	8	26	6 7/8	3 1/8	22 3/8	2 3/8	1	30	1"
182T 184T	10	26	7 1/4	3 3/4	24	2 3/4	7/8	43	—

NOTES:

1. Pump will be shipped with top vertical discharge position as standard. For other orientations, remove casing bolts, rotate discharge to desired position, replace and tighten 6mm bolts to 5 – 6 lbs.-ft.
2. Motor dimensions may vary with motor manufacturers.
3. Dimensions in inches, weights in pounds.
4. For explosion proof motor dimensions consult factory for information.
5. Not to be used for construction purposes unless certified.

NOTAS:

1. *Las bombas se transportarán con la descarga vertical superior como estándar. Para otras orientaciones, retirar los tornillos de la carcasa, rotar la descarga a la posición deseada, y reemplazar y apretar los tornillos de 6mm a 5 – 6 libras-pies.*
2. *Las dimensiones del motor puede que varíen con los fabricantes.*
3. *Dimensiones en pulgadas, pesos en libras.*
4. *Para las dimensiones de los motores a prueba de explosión consultar con la fábrica para información.*
5. *No usar para propósitos de construcción sin certificar.*

Frame Size, *Tamaño del Armazón*	Horsepower, *Fuerza* 3500 RPM Single Phase, *Monofásicos* ODP	TEFC	Three Phase, *Trifásicos* ODP	TEFC	C Max.	Wt. Max., *Peso Máx.*
56	1/2 – 1 1/2	1/2 – 1 1/2	1/2 – 1	1/2 – 1	13	45
143T	—	—	1 1/2	1 1/2	13 3/8	45
145T	2	2	1 1/2 – 3	1 1/2 – 2	14 1/4	52
182T	3	3	5	3	16 5/8	63
184T	5	5	—	5	18 1/8	112

ITT

Commercial Water

Typical Applications, *Aplicaciones Típicas*

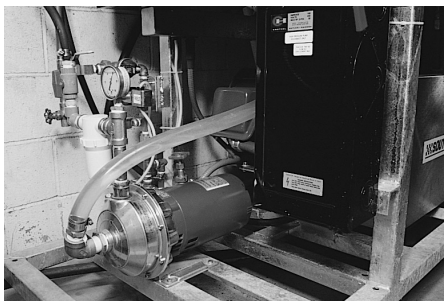
Specifically designed for a broad range of general applications traditionally requiring various materials such as all iron, bronze fitted or all bronze construction.

- Water circulation
- Booster service
- Liquid transfer
- Spray system
- Chillers
- Washing/cleaning systems
- Injection molding cooling
- Reverse osmosis
- Air scrubbers
- Heat exchangers
- Filtration systems
- Jockey pumps
- OEM applications
- General water services

Diseñadas específicamente para una amplia variedad de aplicaciones generales, requiriendo tradicionalmente varios materiales, tales como hierro, bronce empotrado o todas las construcciones de bronce.

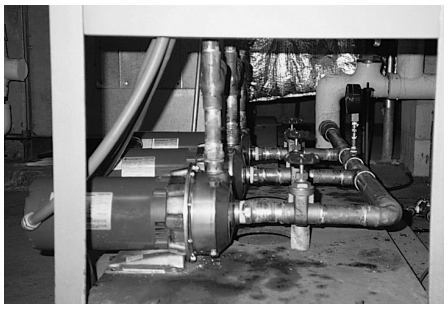
- *Circulación de agua*
- *Aumento de presión*
- *Transferencia de líquidos*
- *Sistemas de aspersión*
- *Enfriadores*
- *Sistemas de lavado/limpieza*
- *Enfriamiento con molde por inyección*
- *Osmosis reversa*
- *Depuradores de aire*
- *Termopermutadores*
- *Sistemas de filtración*
- *Bombas auxiliares*
- *Aplicaciones OEM*
- *Servicios generales de agua*

Brewery, *Fábrica de Cerveza*



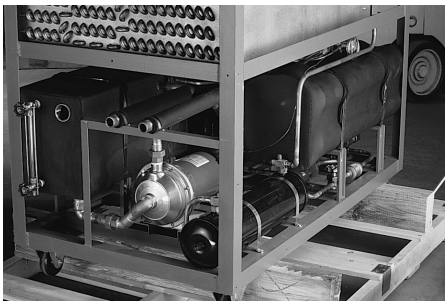
Car Wash, *Lavadero de Autos*

Pure Water/ OEM, *Agua Pura/ OEM*



Pressure Booster System, *Sistema de Aumento de Presión*

Chiller, *Enfriador*



GOULDS PUMPS

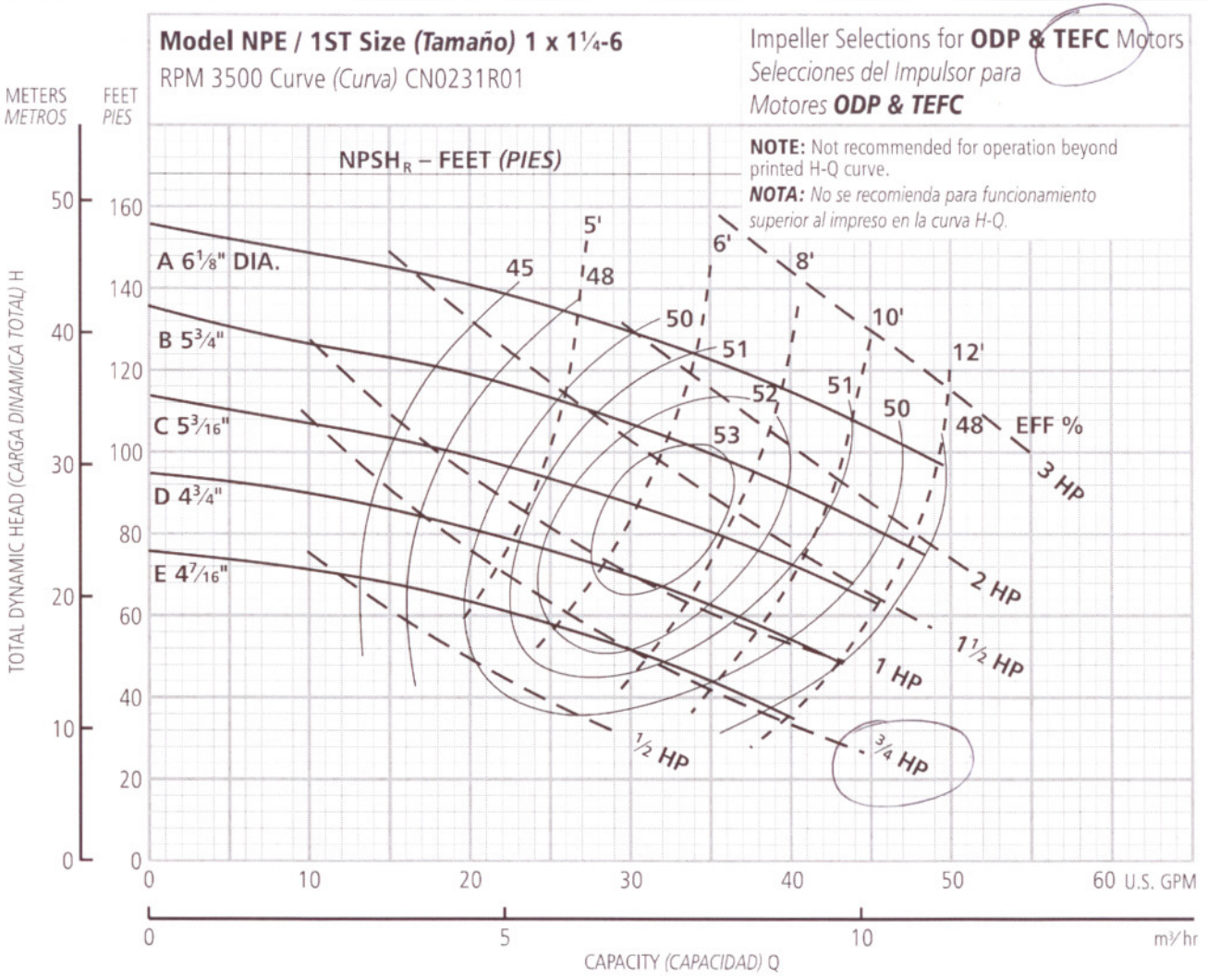
BNPE June, 2008

Junio, 2008

Engineered for life

1ST1D5D4 316 S.S.

Performance Curves – 60 Hz, 3500 RPM
Curvas de Funcionamiento – 60 Hz, 3500 RPM



Ordering Code, *Código de Pedido*	Standard HP Rating, *Estándar HP Potencia*	Imp. Dia.
E	½	4⁷⁄₁₆"
D	¾	4¾
C	1	5³⁄₁₆
B	1½	5¾
A	2	6⅛

NOTE: Although not recommended, the pump may pass a ⅛" sphere.

NOTA: *Si bien no se recomienda, la bomba puede pasar una esfera de ⅛".*

Model NPE / 1ST Size (Tamaño) 1 x 1¼-6 Impeller Selections for **Exp. Proof** Motors

Ordering	Standard

USG U.S. Gauge

Product Data

Temperature Products

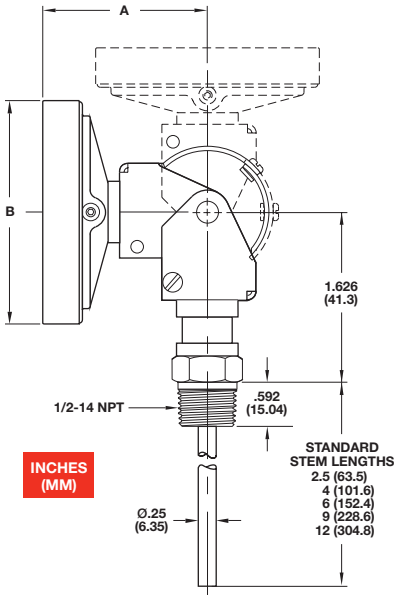
Model ADJ 3” and 5” Adjustable Angle Industrial Bimetallic Thermometers

DESCRIPTION

U.S. Gauge offers 3” and 5” heavy duty, industrial bimetallic thermometers with a versatile case and stem that can be adjusted to almost any angle for easy viewing. The head can be rotated 360° and the stem positioning moves over 180°. These thermometers are rugged and preferred by the process, offshore, power, pharmaceutical, and chemical industries.

Model ADJ

The union connection is 1/2-14 NPT, but others are available. The thermometers may be silicone filled for additional vibration dampening (5” only) . The standard lens material is glass. Standard stem diameter, up to 12” long, is .25”. Other available stem sizes are .24” (6mm), .32” (8mm), and .375” (9.52mm).



SPECIFICATIONS

STEM DIAMETER: .25” standard up to 12” stem

CONNECTION: 1/2-14 NPT

EXTERNAL RESET: Standard

CONSTRUCTION: 304 stainless steel external parts and welded construction; corrosion resistant to most chemicals

HERMETIC SEAL: Per ASME B40.3, dustproof and leakproof

HARNESS: All stainless steel brackets with screws that loosen to allow 360° rotation of head and 180° adjustment of stem position

BELLOWS: Heavy-duty flexible stainless steel, hermetically sealed at case and connection; protects mechanism that transfers temperature

DIAL: Cupped anti-parallax dial, easy to read from any angle, minimizes reading errors; anodized aluminum with large black numbers and graduations. Outer scale in Fahrenheit; inner scale Celsius.

LENS: Glass

BIMETALLIC COIL: Helix coil is silicone coated on ranges below 500°F for vibration dampening and to maximize heat transfer and response time

ACCURACY: ±1% full span per ASME B40.3 Grade A; adjustment of the angle between case and stem may affect accuracy up to 0.5% of span (ASME B40.3)

OVER TEMPERATURE LIMITS: Up to 250°F, 100%; 250° to 550°F, 50%; 550° to 1000°F, continuous use up to 800°F, intermittent use over 800°F

MODEL	UNIT	A	B
ADJ-3	inches	2.300	3.134
	mm	58.42	79.60
ADJ-5	inches	2.631	5.001
	mm	66.83	127.03

AMETEK®
www.ametekusg.com

Printed in the U.S.A. 908PDF (160166)

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Sales/Technical Support: 215-257-6531
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Customer Service: 727-536-7831
8600 Somerset Drive
Largo, FL 33773 U.S.A.

ISO 9001:2000 CERTIFIED

Specifications are subject to change without notice. Visit our Web site for the most up-to-date information.

USG U.S. Gauge

Product Data

Temperature Products

Model ADJ 3” and 5” Adjustable Angle Industrial Bimetallic Thermometers

SPEC NUMBER SELECTION CHART

Model ADJ-3 — 3” Dial Size

Connection	Temperature Range*	2-1/2” Stem Length Spec No.	4” Stem Length Spec No.	6” Stem Length Spec No.	9” Stem Length Spec No.	12” Stem Length Spec No.
1/2-14 NPT	0° to 200° FC	415002C	415008C	415014C	415020C	415026C
	0° to 250° FC	415003C	415009C	415015C	415021C	415027C
	50° to 300° FC	415004C	415010C	415016C	415022C	415028C
	50° to 400° FC	415005C	415011C	415017C	415023C	415029C
	50° to 550° FC	415006C	415012C	415018C	415024C	415030C
	200° to 1000° FC	415007C	415013C	415019C	415025C	415031C

Model ADJ-5 — 5” Dial Size

Connection	Temperature Range*	2-1/2” Stem Length Spec No.	4” Stem Length Spec No.	6” Stem Length Spec No.	9” Stem Length Spec No.	12” Stem Length Spec No.
1/2-14 NPT	25° to 125° FC	–	415038C	415045C	–	–
	0° to 200° FC	415032C	415039C	415046C	415052C	415058C
	0° to 250° FC	415033C	415040C	415047C	415053C	415059C
	50° to 300° FC	415034C	415041C	415048C	415054C	415060C
	50° to 400° FC	415035C	415042C	415049C	415055C	415061C
	50° to 550° FC	415036C	415043C	415050C	415056C	415062C
	200° to 1000° FC	415037C	415044C	415051C	415057C	415063C

* All dials are dual scale, Fahrenheit outer scale, Celsius inner scale

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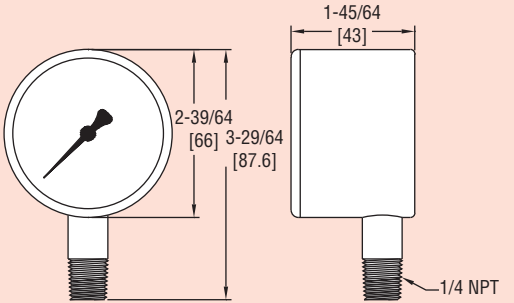
Series LPG1

Low Pressure Gage

1.5% Accuracy in 2.5″ Chrome Case



The Series LPG1 Low Pressure Gages possess inches of water column scales with 1.5% accuracy. The 2.5″ LPG1 gages are designed with chrome plated steel housings and twist lock plastic lenses. Units are ideal for air and gases compatible with brass. Units can withstand ambient temperatures of -40 to 140°F (-40 to 60°C). A wide offering of ranges are available from vacuum to 10 psi. Units come with a 1/4″ male NPT bottom connection.

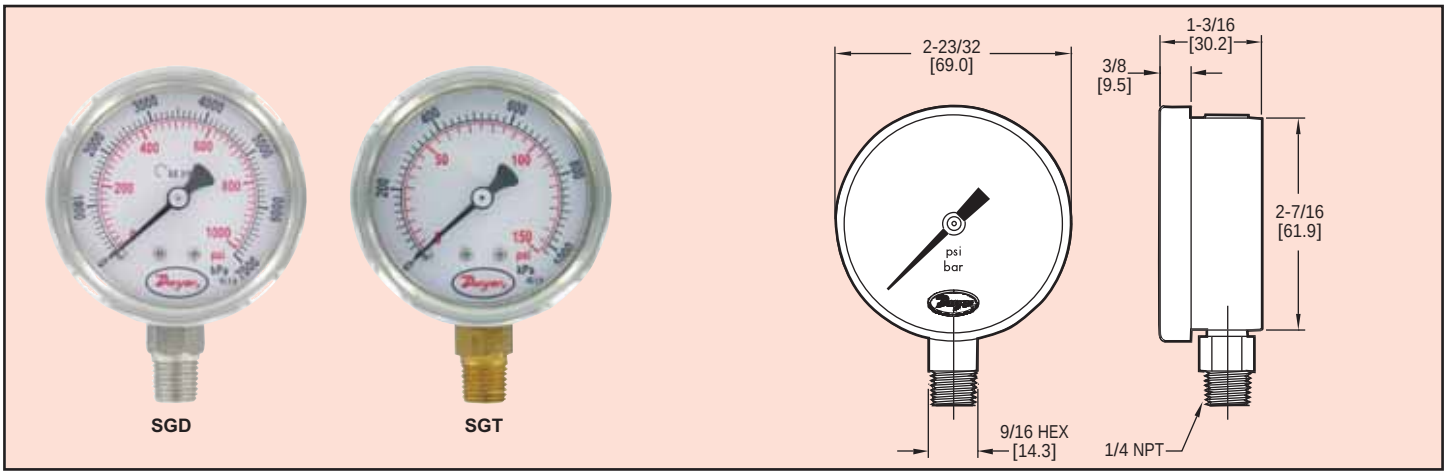
Model	Range	Price
LPG1-D7322N	-30-0″ w.c.	$35.50
LPG1-D7522N	-60-0″ w.c	35.50
LPG1-D7722N	-100-0″ w.c.	35.50
LPG1-D7922N	-200-0″ w.c.	35.50
LPG1-D8022N	0-10″ w.c.	35.50
LPG1-D8122N	0-15″ w.c.	35.50
LPG1-D8222N	0-30″ w.c.	35.50
LPG1-D8422N	0-60″ w.c.	35.50
LPG1-D8622N	0-100″ w.c.	35.50
LPG1-D8722N	0-160″ w.c.	35.50
LPG1-D8822N	0-200″ w.c.	35.50
LPG1-D9822N	0-3 psi	35.50
LPG1-D9922N	0-5 psi	35.50
LPG1-D0022N	0-10 psi	35.50

SPECIFICATIONS

Service: Air and compatible gases.
Wetted Materials: Brass socket and internals.
Housing: Chrome-plated case.
Lens: Plastic.
Accuracy: 1.5%.
Pressure Limit: 110% of full scale.
Temperature Limits: Process: -40 to 140°F (-40 to 60°C).
Size: 2.5″ (63 mm).
Process Connection: 1/4″ male NPT lower.
Weight: 8.64 oz (245 g).

Series SGD & SGT 2.5″ Stainless Steel Industrial Pressure Gage

1.6% Full Scale Accuracy, 316 SS or Brass Wetted Parts



The Series SGD/SGT Gages have dual English/metric scales with ±1.6% full scale accuracy. The Series SGD/SGT gages are designed with 304 SS housings and 316 SS or brass wetted parts for excellent chemical compatibility. These gages cover a wide variety of ranges from full vacuum to 15,000 psi. Series SGD/SGT gages may be easily liquid filled in the field without the need for a seperate kit.

APPLICATIONS

- Vacuums in pneumatic conveying lines.
- Positive pressure in compressed air headers.

SPECIFICATIONS

Service: Compatible gases and liquids.
Wetted Materials: SGD: 316 SS; SGT: Brass.
Housing: 304 SS.
Lens: Plexi-glass.
Accuracy: ±1.6% full scale.
Pressure Limit: 130% full scale for ranges <6000 psi, 115% for 6000 psi and greater.
Temperature Limits: SGD: Ambient: -4 to 149°F (-25 to 65°C), Process: 518°F max. (270°C max.); SGT: Ambient: -4 to 140°F (-20 to 60°C), Process: 248°F max. (120°C max.).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Enclosure Rating: NEMA 3 (IP55).
Weight: 4.6 oz (0.13 kg).

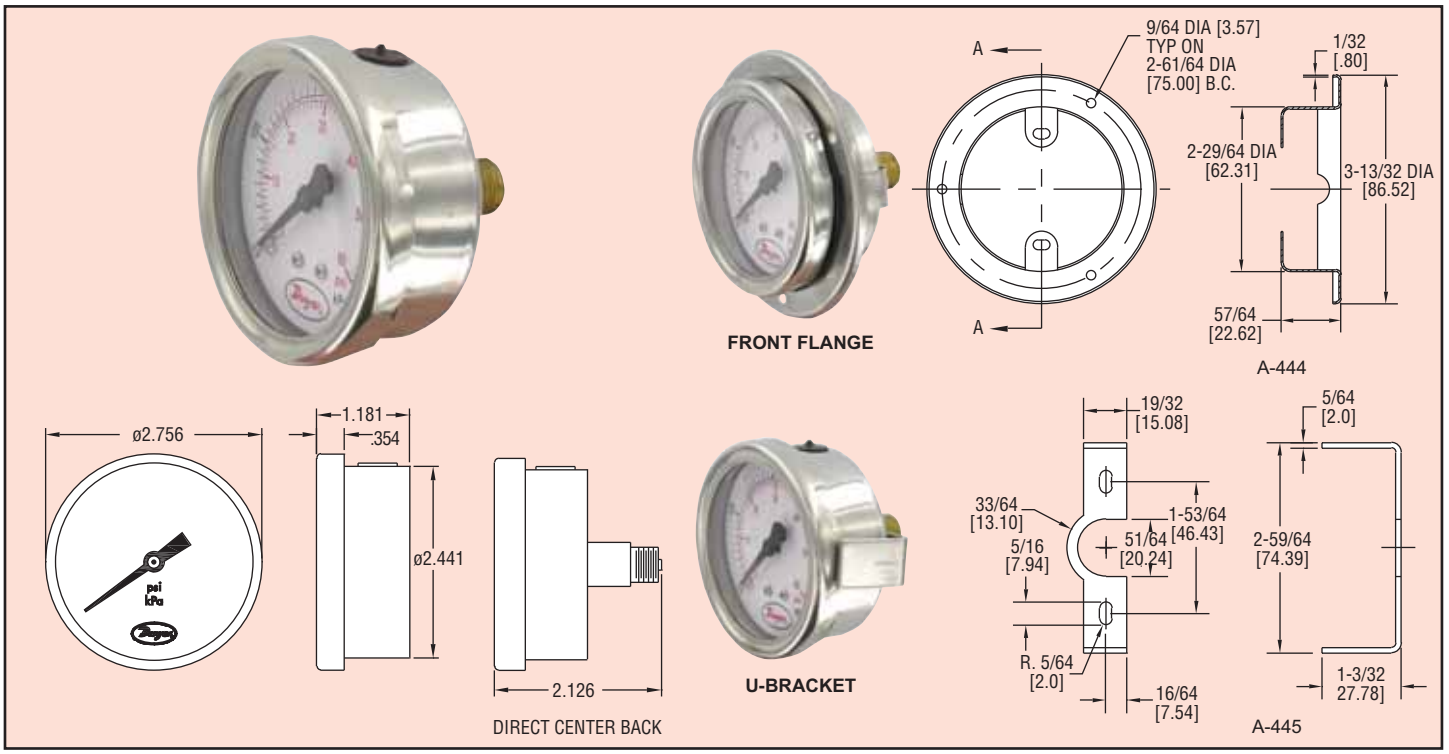
316SS Gages			Brass Gages		
Model	**Range**	**Price**	**Model**	**Range**	**Price**
SGD-D0122N	30″ Hg-0 (-100-0 kPa)	**$42.80**	**SGT-D0122N**	30″ Hg-0 (-100-0 kPa)	**$13.00**
SGD-D0222N	0-15 psi (0-100 kPa)	**42.80**	**SGT-D0222N**	0-15 psi (0-100 kPa)	**13.00**
SGD-D0322N	0-30 psi (0-200 kPa)	**42.80**	**SGT-D0322N**	0-30 psi (0-200 kPa)	**11.50**
SGD-D0422N	0-60 psi (0-400 kPa)	**35.00**	**SGT-D0422N**	0-60 psi (0-400 kPa)	**11.50**
SGD-D0522N	0-100 psi (0-700 kPa)	**35.00**	**SGT-D0522N**	0-100 psi (0-700 kPa)	**11.50**
SGD-D0622N	0-150 psi (0-1000 kPa)	**35.00**	**SGT-D0622N**	0-150 psi (0-1000 kPa)	**11.50**
SGD-D0722N	0-200 psi (0-1400 kPa)	**35.00**	**SGT-D0722N**	0-200 psi (0-1400 kPa)	**11.50**
SGD-D0822N	0-300 psi (0-2000 kPa)	**35.00**	**SGT-D0822N**	0-300 psi (0-2000 kPa)	**11.50**
SGD-D0922N	0-400 psi (0-2800 kPa)	**35.00**	**SGT-D0922N**	0-400 psi (0-2800 kPa)	**11.50**
SGD-D1022N	0-500 psi (0-3400 kPa)	**35.00**	**SGT-D1022N**	0-500 psi (0-3400 kPa)	**11.50**
SGD-D1122N	0-600 psi (0-4000 kPa)	**35.00**	**SGT-D1122N**	0-600 psi (0-4000 kPa)	**11.50**
SGD-D1222N	0-1000 psi (0-7000 kPa)	**35.00**	**SGT-D1222N**	0-1000 psi (0-7000 kPa)	**11.50**
SGD-D1322N	0-1500 psi (0-10 MPa)	**42.80**	**SGT-D1322N**	0-1500 psi (0-10 MPa)	**16.50**
SGD-D1422N	0-2000 psi (0-14 MPa)	**42.80**	**SGT-D1422N**	0-2000 psi (0-14 MPa)	**16.50**
SGD-D1522N	0-3000 psi (0-20 MPa)	**42.80**	**SGT-D1522N**	0-3000 psi (0-20 MPa)	**16.50**
SGD-D1622N	0-4000 psi (0-28 MPa)	**42.80**	**SGT-D1622N**	0-4000 psi (0-28 MPa)	**16.50**
SGD-D1722N	0-5000 psi (0-34 MPa)	**42.80**	**SGT-D1722N**	0-5000 psi (0-34 MPa)	**16.50**
SGD-D1822N	0-6000 psi (0-40 MPa)	**42.80**	**SGT-D1822N**	0-6000 psi (0-40 MPa)	**16.50**
SGD-D2122N	30″ Hg-0-15 psi (-100-0-100 kPa)	**40.00**	**SGT-D2122N**	30″ Hg-0-15 psi (-100-0-100 kPa)	**13.00**
SGD-D2222N	30″ Hg-0-30 psi (-100-0-200 kPa)	**40.00**	**SGT-D2222N**	30″ Hg-0-30 psi (-100-0-200 kPa)	**13.00**
SGD-D2322N	30″ Hg-0-60 psi (-100-0-400 kPa)	**40.00**	**SGT-D2322N**	30″ Hg-0-60 psi (-100-0-400 kPa)	**13.00**
SGD-D2422N	30″ Hg-0-100 psi (-100-0-700 kPa)	**40.00**	**SGT-D2422N**	30″ Hg-0-100 psi (-100-0-700 kPa)	**13.00**
SGD-D2522N	30″ Hg-0-150 psi (-100-0-1000 kPa)	**40.00**	**SGT-D2522N**	30″ Hg-0-150 psi (-100-0-1000 kPa)	**13.00**
SGD-D2622N	30″ Hg-0-200 psi (-100-0-1400 kPa)	**40.00**	**SGT-D2622N**	30″ Hg-0-200 psi (-100-0-1400 kPa)	**13.00**
SGD-D2722N	30″ Hg-0-300 psi (-100-0-2000 kPa)	**40.00**	**SGT-D2722N**	30″ Hg-0-300 psi (-100-0-2000 kPa)	**13.00**

Note: To order with glycerin fill add - PY to the end of the model . . . . . .add $5.00

Series SGD & SGT

2.5″ Stainless Steel Industrial Pressure Gages

Back Connect with Optional Front Flange or U-Bracket



The Series SGD/SGT Gages have dual English/metric scales with ±1.6% full scale accuracy. The Series SGD/SGT gages are designed with 304 SS housings and 316 SS or brass wetted parts for excellent chemical compatibility. These gages cover a wide variety of ranges from full vacuum to 6,000 psi. Series SGD/SGT gages may be ordered dry or with liquid fill. Gages can be mounted in various configurations with optional mounting kits.

ACCESSORIES

Model	Description	Price
A-445	U-Bracket Mounting Kit for 2.5″ Gage	**$3.00**
A-444	Front Panel Mounting Flange Kit for 2.5″ Gage	**3.50**

SPECIFICATIONS

Service: Compatible gases and liquids.
Wetted Materials: SGD: 316 SS; SGT: Brass.
Housing: 304 SS.
Lens: Acrylic.
Accuracy: ±1.6% full scale.
Pressure Limit: 130% full scale for ranges <6000 psi, 115% for 6000 psi.
Temperature Limits: SGD: Ambient: -4 to 149°F (-25 to 65°C), Process: 518°F max. (270°C max.); SGT: Ambient: -4 to 140°F (-20 to 60°C), Process: 248°F max. (120°C max.).
Size: 2.5″ (63 mm).
Process Connections: 1/4″ male NPT.
Enclosure Rating: NEMA 3 (IP55).
Weight: 4.6 oz (0.13 kg).

Stainless Steel Model	Range	Price
SGD-D0142N	30″ Hg-0 (-100-0 kPa)	**$47.80**
SGD-D0242N	0-15 psi (0-100 kPa)	**47.80**
SGD-D0342N	0-30 psi (0-200 kPa)	**47.80**
SGD-D0442N	0-60 psi (0-400 kPa)	**40.00**
SGD-D0542N	0-100 psi (0-700 kPa)	**40.00**
SGD-D0642N	0-150 psi (0-1000 kPa)	**40.00**
SGD-D0742N	0-200 psi (0-1400 kPa)	**40.00**
SGD-D0842N	0-300 psi (0-2000 kPa)	**40.00**
SGD-D0942N	0-400 psi (0-2800 kPa)	**40.00**
SGD-D1042N	0-500 psi (0-3400 kPa)	**40.00**
SGD-D1142N	0-600 psi (0-4000 kPa)	**40.00**
SGD-D1242N	0-1000 psi (0-7000 kPa)	**40.00**
SGD-D1342N	0-1500 psi (0-10 MPa)	**47.80**
SGD-D1442N	0-2000 psi (0-14 MPa)	**47.80**
SGD-D1542N	0-3000 psi (0-20 MPa)	**47.80**
SGD-D1642N	0-4000 psi (0-28 MPa)	**47.80**
SGD-D1742N	0-5000 psi (0-34 MPa)	**47.80**
SGD-D1842N	0-6000 psi (0-40 MPa)	**47.80**
SGD-D2142N	30″ Hg-0-15 psi (-100-0-100 kPa)	**45.00**
SGD-D2242N	30″ Hg-0-30 psi (-100-0-200 kPa)	**45.00**
SGD-D2342N	30″ Hg-0-60 psi (-100-0-400 kPa)	**45.00**
SGD-D2442N	30″ Hg-0-100 psi (-100-0-700 kPa)	**45.00**
SGD-D2542N	30″ Hg-0-150 psi (-100-0-1000 kPa)	**45.00**
SGD-D2642N	30″ Hg-0-200 psi (-100-0-1400 kPa)	**45.00**
SGD-D2742N	30″ Hg-0-300 psi (-100-0-2000 kPa)	**45.00**

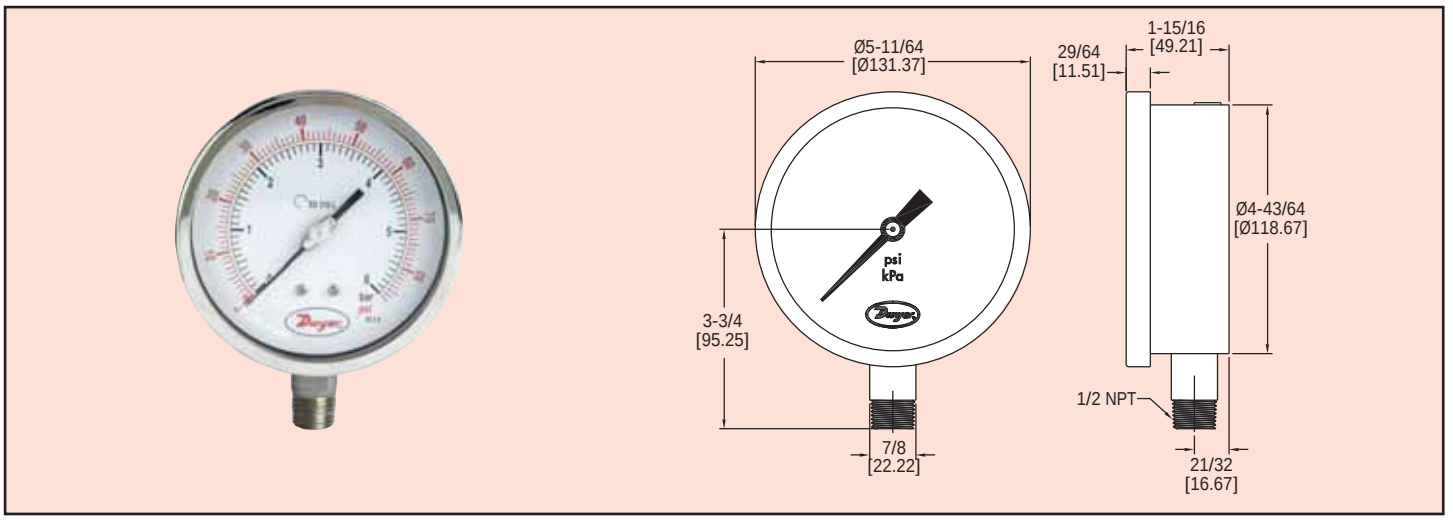
Brass Model	Range	Price
SGT-D0142N	30″ Hg-0 (-100-0 kPa)	**$16.00**
SGT-D0242N	0-15 psi (0-100 kPa)	**16.00**
SGT-D0342N	0-30 psi (0-200 kPa)	**14.50**
SGT-D0442N	0-60 psi (0-400 kPa)	**14.50**
SGT-D0542N	0-100 psi (0-700 kPa)	**14.50**
SGT-D0642N	0-150 psi (0-1000 kPa)	**14.50**
SGT-D0742N	0-200 psi (0-1400 kPa)	**14.50**
SGT-D0842N	0-300 psi (0-2000 kPa)	**14.50**
SGT-D0942N	0-400 psi (0-2800 kPa)	**14.50**
SGT-D1042N	0-500 psi (0-3400 kPa)	**14.50**
SGT-D1142N	0-600 psi (0-4000 kPa)	**14.50**
SGT-D1242N	0-1000 psi (0-7000 kPa)	**14.50**
SGT-D1342N	0-1500 psi (0-10 MPa)	**19.50**
SGT-D1442N	0-2000 psi (0-14 MPa)	**19.50**
SGT-D1542N	0-3000 psi (0-20 MPa)	**19.50**
SGT-D1642N	0-4000 psi (0-28 MPa)	**19.50**
SGT-D1742N	0-5000 psi (0-34 MPa)	**19.50**
SGT-D1842N	0-6000 psi (0-40 MPa)	**19.50**
SGT-D2142N	30″ Hg-0-15 psi (-100-0-100 kPa)	**16.00**
SGT-D2242N	30″ Hg-0-30 psi (-100-0-200 kPa)	**16.00**
SGT-D2342N	30″ Hg-0-60 psi (-100-0-400 kPa)	**16.00**
SGT-D2442N	30″ Hg-0-100 psi (-100-0-700 kPa)	**16.00**
SGT-D2542N	30″ Hg-0-150 psi (-100-0-1000 kPa)	**16.00**
SGT-D2642N	30″ Hg-0-200 psi (-100-0-1400 kPa)	**16.00**
SGT-D2742N	30″ Hg-0-300 psi (-100-0-2000 kPa)	**16.00**

Note: To order with glycerin fill add - PY to the end of the model. . . . . **.add $5.00**

Series SGL

4.5″ Stainless Steel Industrial Pressure Gage

1% Full Scale Accuracy, 316 SS Wetted Parts, NEMA 4X



The Series SGL Gages have dual English/metric scales with ±1.0% full scale accuracy. For excellent chemical compatibility, the Series SGL gages are designed with 304 SS housings and 316L SS wetted parts. Units can withstand ambient temperatures up to 149°F (65°C) and process temperatures up to 572°F (300°C). Series SGL gages may be easily liquid filled in the field without the need for a separate kit. Included is a micrometer adjustable pointer which allows for re-zeroing the gage in the field. A wide selection of ranges are available from full vacuum, compound to 20,000 psi.

APPLICATIONS

Cryogenics, Pharmaceutical, Chemical, Petrochemical, Food and Beverage, Conventional and Nuclear Power, Pumps, Presses, Diesel Engines, Turbines and Compressors.

SPECIFICATIONS

Service: Compatible gases & liquids.
Wetted Materials: 316L SS.
Lens: Shatterproof safety glass.
Housing: 304 SS.
Accuracy: ±1.0% full scale, ANSI B40.1 Grade 1A.
Pressure Limit: 130% full scale for ranges <10,000 psi, 115% for 10,000 psi and greater.
Temperature Limits:
Ambient: -13 to 149°F (-25 to 65°C)
Process: 572°F max. (300°C max.).
Size: 4.5″ (115 mm).
Process Connections: 1/2″ male NPT.
Enclosure Rating: NEMA 4X (IP65).
Weight: 1.5 lb (0.70 kg).

Model	Ranges	Price	Model	Ranges	Price
SGL-G0124N	30″ Hg-0 (-100-0 kPa)	**$65.00**	**SGL-G1624N**	0-4000 psi (0-28 MPa)	**$65.00**
SGL-G0224N	0-15 psi (0-100 kPa)	**65.00**	**SGL-G1724N**	0-5000 psi (0-34 MPa)	**65.00**
SGL-G0324N	0-30 psi (0-200 kPa)	**55.00**	**SGL-G1824N**	0-6000 psi (0-40 MPa)	**65.00**
SGL-G0424N	0-60 psi (0-400 kPa)	**55.00**	**SGL-G1924N**	0-10000 psi (0-70 MPa)	**75.00**
SGL-G0524N	0-100 psi (0-700 kPa)	**55.00**	**SGL-G2024N**	0-15000 psi (0-100 MPa)	**75.00**
SGL-G0624N	0-150 psi (0-1000 kPa)	**55.00**	**SGL-G2124N**	30″ Hg-0-15 psi (-100-0-100 kPa)	**60.00**
SGL-G0724N	0-200 psi (0-1400 kPa)	**55.00**	**SGL-G2224N**	30″ Hg-0-30 psi (-100-0-200 kPa)	**60.00**
SGL-G0824N	0-300 psi (0-2000 kPa)	**55.00**	**SGL-G2324N**	30″ Hg-0-60 psi (-100-0-400 kPa)	**60.00**
SGL-G0924N	0-400 psi (0-2800 kPa)	**55.00**	**SGL-G2424N**	30″ Hg-0-100 psi (-100-0-700 kPa)	**60.00**
SGL-G1024N	0-500 psi (0-3400 kPa)	**55.00**	**SGL-G2524N**	30″ Hg-0-150 psi (-100-0-1000 kPa)	**60.00**
SGL-G1124N	0-600 psi (0-4000 kPa)	**55.00**	**SGL-G2624N**	30″ Hg-0-200 psi (-100-0-1400 kPa)	**60.00**
SGL-G1224N	0-1000 psi (0-7000 kPa)	**65.00**	**SGL-G2724N**	30″ Hg-0-300 psi (-100-0-2000 kPa)	**60.00**
SGL-G1324N	0-1500 psi (0-10 MPa)	**65.00**	**SGL-G2924N**	0-20000 psi (0-140 MPa)	**110.00**
SGL-G1424N	0-2000 psi (0-14 MPa)	**65.00**			
SGL-G1524N	0-3000 psi (0-20 MPa)	**65.00**			

Model 9545

VelociCalc® Air Velocity Meters

Models 9535, 9535-A, 9545 and 9545-A

The Models 9535 and 9545 air velocity meters are like having multiple meters—for the price of just one. These meters simultaneously measure and data log several ventilation parameters using a single probe with multiple sensors. Both models measure velocity, temperature and calculate flow. The Model 9545 also measures relative humidity, and calculates dew point, and wet bulb temperature. Models 9535 and 9545 have telescopic straight probes; Models 9535-A and 9545-A have telescopic articulated probes.

Features and Benefits

- Simple to operate
- Accurate air velocity measurement
- Simultaneously measure temperature and velocity
- Displays up to three measurements simultaneously
- Measures humidity (Model 9545 and 9545-A)
- Calculates volumetric flow and actual/standard velocity
- Data log 12,700+ samples and 100 test IDs
- LogDat2™ downloading software included
- Articulated probe versions available (9535-A and 9545-A)

Applications

- HVAC system performance
- Commissioning
- Plant maintenance
- Critical environment certification
- Duct traverses

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Specifications

VelociCalc Models 9535 and 9545

Velocity
Range 0 to 6,000 ft/min (0 to 30 m/s)
Accuracy[1&2] ±3% of reading or ±3 ft/min (±0.015 m/s), whichever is greater
Resolution 1 ft/min (0.01 m/s)

Duct Size
Dimensions 1 to 250 inches in increments of 0.1 in. (1 to 635 cm in increments of 0.1 cm)

Volumetric Flow Rate
Range Actual range is a function of velocity and duct size

Temperature
Range (9535 and 9535-A)
0 to 200 °F (-18 to 93°C)
Range (9545 and 9545-A)
14 to 140°F (-10 to 60°C)
Accuracy[3] ±0.5°F (±0.3°C)
Resolution 0.1°F (0.1°C)

Relative Humidity (9545 only)
Range 0 to 95% RH
Accuracy[4] ±3% RH
Range 0.1% RH

Instrument Temperature Range
Operating (Electronics)
40 to 113°F (5 to 45°C)
Model 9535 Operating (Probe)
0 to 200°F (-18 to 93°C)
Model 9545 Operating (Probe)
14 to 140°F (-10 to 60°C)
Storage -4 to 140°F (-20 to 60°C)

Data Storage Capabilities
Range 12,700+ samples and 100 test IDs

Logging Interval
1 second to 1 hour

Time Constant
User selectable

External Meter Dimensions
3.3 in. x 7.0 in. x 1.8 in. (8.4 cm x 17.8 cm x 4.4 cm)

Meter Weight with Batteries
0.6 lbs. (0.27 kg)

Meter Probe Dimensions
Probe Length 40 in. (101.6 cm)
Probe Diameter of Tip
0.28 in. (7.0 mm)
Probe Diameter of Base
0.51 in. (13.0 mm)

Articulating Probe Dimensions
Articulating Section Length
7.8 in. (19.7 cm)
Diameter of Articulating Knuckle
0.38 in. (9.5 mm)

Power Requirements
Four AA-size batteries or AC adapter

	9535, 9535-A	9545, 9545-A
Velocity	•	•
Temperature	•	•
Flow	•	•
Humidity, wet bulb, dew point		•
Probe	Straight or -A articulated	Straight or -A articulated
Variable time constant	•	•
Manual data logging	•	•
Auto save data logging		•
Statistics	•	•
Review data	•	•
LogDat2 downloading software	•	•
Certificate of Calibration	•	•

[1] Temperature compensated over an air temperature range of 40 to 150°F (5 to 65°C).
[2] The accuracy statement begins at 30 ft/min through 6,000 ft/min (0.15 m/s through 30 m/s). Accuracy with instrument case at 77°F (25°C), add uncertainty of 0.05°F/°F (0.03°C/°C) for change in instrument temperature.
[3] Accuracy with probe at 77°F (25°C). Add uncertainty of 0.1% RH/°F (0.2% RH/°C) for change in probe temperature. Includes 1% hysteresis.

Specifications are subject to change without notice.

TSI Incorporated · 500 Cardigan Road, Shoreview, MN 55126-3996 USA

USA	Tel: +1 800 874 2811	E-mail: info@tsi.com	Website: www.tsi.com
UK	Tel: +44 149 4 459200	E-mail: tsiuk@tsi.com	Website: www.tsiinc.co.uk
France	Tel: +33 491 95 21 90	E-mail: tsifrance@tsi.com	Website: www.tsiinc.fr
Germany	Tel: +49 241 523030	E-mail: tsigmbh@tsi.com	Website: www.tsiinc.de
Sweden	Tel: +46 8 595 13230	E-mail: tsiab@tsi.com	Website: www.tsi.se
India	Tel: +91 80 41132470	E-mail: tsi-india@tsi.com	
China	Tel: +86 10 8260 1595	E-mail: tsibeijing@tsi.com	

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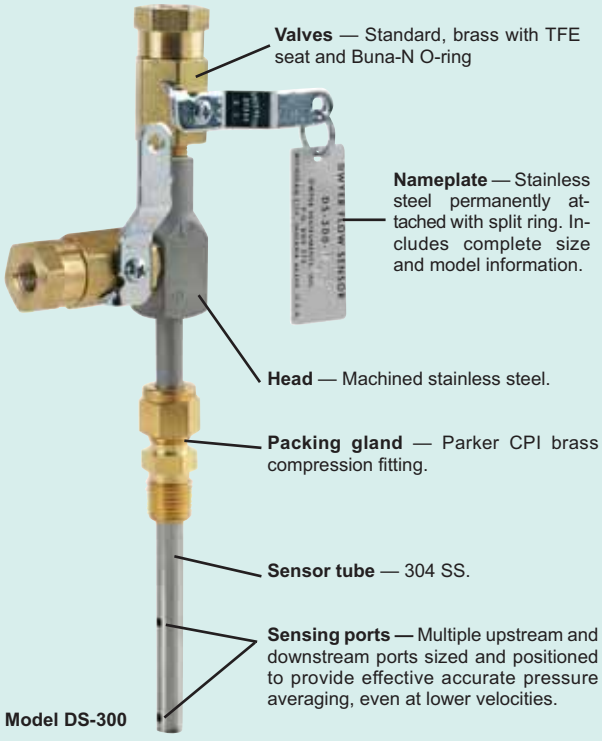
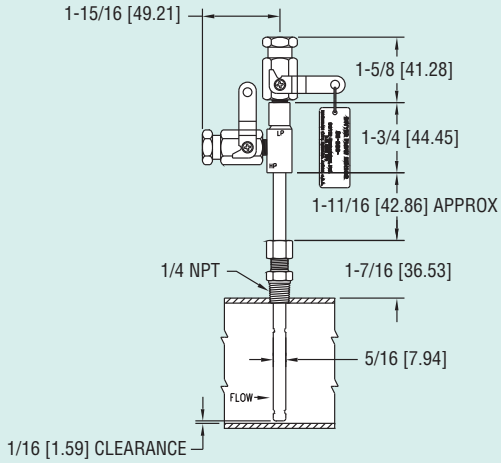
Series DS

In-Line Flow Sensors

Use with the Dwyer® Differential Pressure Gages or Transmitters





In-Line Flow Sensors are averaging Pitot tubes that provide accurate and convenient flow rate sensing for schedule 40 pipe. When purchased with a Dwyer® Capsuhelic® differential pressure gage of appropriate range, the result is a flow indicating system delivered off the shelf at an economical price.
Pitot tubes have been used in flow measurement for years. Conventional pitot tubes sense velocity pressure at only one point in the flowing stream. Therefore, a series of measurements must be taken across the stream to obtain a meaningful average flow rate. The Dwyer® flow sensor eliminates the need for "traversing" the flowing stream because of its multiple sensing points and built-in averaging capability.

The Series DS-300 flow sensors are designed to be inserted in the pipeline through a compression fitting. They are furnished with instrument shut-off valves on both pressure connections. Valves are fitted with 1/8″ female NPT connections. Accessories include adapters with 1/4″ SAE 45° flared ends compatible with hoses supplied with the Model A-471 Portable Capsuhelic® gage kit. Standard valves are rated at 200 psig (13.7 bar) and 200°F (93.3°C). Where valves are not required, they can be omitted at reduced cost. Series DS-300 flow sensors are available for pipe sizes from 1″ to 10″.

DS-400 Averaging Flow Sensors are quality constructed from extra strong 3/4″ dia. stainless steel to resist increased forces encountered at higher flow rates with both air and water. This extra strength also allows them to be made in longer insertion lengths up to 24 inches (61 cm). All models include convenient and quick-acting quarter-turn ball valves to isolate the sensor for zeroing. Process connections to the valve assembly are 1/8″ female NPT. A pair of 1/8″ NPT X 1/4″ SAE 45° flared adapters are included, compatible with hoses used in the Model A-471 Portable Capsuhelic® Gage Kit. Supplied solid brass mounting adapter has a 3/4″ dia. compression fitting to lock in required insertion length and a 3/4″ male NPT thread for mounting in a Threaded Branch Connection.

Prices — Select model with suffix which matches pipe size

Model DS-300-1″	**$130.00**
Model DS-300-1-1/4″	**130.00**
Model DS-300-1-1/2″	**130.00**
Model DS-300-2″	**130.00**
Model DS-300-2-1/2″	**130.00**
Model DS-300-3″	**150.00**
Model DS-300-4″	**178.00**
Model DS-300-6″	**226.00**
Model DS-300-8″	**286.00**
Model DS-300-10″	**338.00**
Model DS-400-6″	**$266.00**
Model DS-400-8″	**326.00**
Model DS-400-10″	**381.00**
Model DS-400-12″	**401.00**
Model DS-400-14″	**473.00**
Model DS-400-16″	**517.00**
Model DS-400-18″	**556.00**
Model DS-400-20″	**597.00**
Model DS-400-24″	**678.00**

OPTIONS & ACCESSORIES

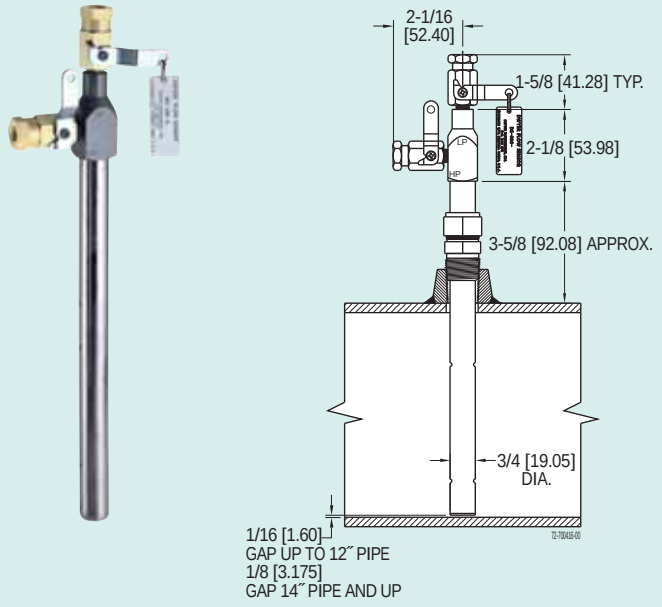
A-160, Threaded Branch Connection, 3/8″ NPT, forged steel, 3000 psi	**$14.25**
A-161, Brass Bushing, 1/4″ x 3/8″	**3.50**
DS-300 or DS-400 Less Valves. To order, add suffix **-LV**	**deduct 13.50**

How To Order

Merely determine the pipe size into which the flow sensor will be mounted and designate the size as a suffix to Model DS-300. For example, a flow sensor to be mounted in a 2″ pipe would be a Model No. DS-300-2″. For non-critical water and air flow monitoring applications, the chart below can be utilized for ordering a stock Capsuhelic® differential pressure gage for use with the DS-300 flow sensor. Simply locate the maximum flow rate for the media being measured under the appropriate pipe size and read the Capsuhelic® gage range in inches of water column to the left. The DS-300 sensor is supplied with installation and operating instructions, Bulletin F-50. It also includes complete flow conversion information for the three media conditions shown in the chart below. This information enables the user to create a complete differential pressure to flow rate conversion table for the sensor and differential pressure gage employed. Both the Dwyer® Capsuhelic® gage and flow sensor feature excellent repeatability so, once the desired flow rate is determined, deviation from that flow in quantitative measure can be easily determined. You may wish to order the adjustable signal flag option for the Capsuhelic® gage to provide an easily identified reference point for the proper flow.

Capsuhelic® gages with special ranges and/or direct reading scales in appropriate flow units are available on special order for more critical applications. Customer supplied data for the full scale flow (quantity and units) is required along with the differential pressure reading at that full flow figure. Prior to ordering a special Capsuhelic® differential pressure gage for flow read-out, we recommend you request Bulletin F-50 to obtain complete data on converting flow rates of various media to the sensor differential pressure output. With this bulletin and after making a few simple calculations, the exact range gage required can easily be determined.

Large 3/4 Inch Diameter for Extra Strength in Lengths to 24 Inches



DS-400

Gage Range (in w.c.)	Media @ 70°F	Full Range Flows by Pipe Size (Approximate)									
		1″	1-1/4″	1-1/2″	2″	2-1/2″	3″	4″	6″	8″	10″
2	Water (GPM)	4.8	8.3	11.5	20.5	30	49	86	205	350	560
	Air @ 14.7 PSIA (SCFM)	19.0	33.0	42.0	65.0	113	183	330	760	1340	2130
	Air @ 100 PSIG (SCFM)	50.0	90.5	120.0	210.0	325	510	920	2050	3600	6000
5	Water (GPM)	7.7	14.0	18.0	34.0	47	78	138	320	560	890
	Air @ 14.7 PSIA (SCFM)	30.0	51.0	66.0	118.0	178	289	510	1200	2150	3400
	Air @ 100 PSIG (SCFM)	83.0	142.0	190.0	340.0	610	820	1600	3300	5700	10000
10	Water (GPM)	11.0	19.0	25.5	45.5	67	110	195	450	800	1260
	Air @ 14.7 PSIA (SCFM)	41.0	72.0	93.0	163.0	250	410	725	1690	3040	4860
	Air @ 100 PSIG (SCFM)	120.0	205.0	275.0	470.0	740	1100	2000	4600	8100	15000
25	Water (GPM)	18.0	32.0	40.5	72.0	108	173	310	720	1250	2000
	Air @ 14.7 PSIA (SCFM)	63.0	112.0	155.0	255.0	390	640	1130	2630	4860	7700
	Air @ 100 PSIG (SCFM)	185.0	325.0	430.0	760.0	1200	1800	3300	7200	13000	22000
50	Water (GPM)	25.0	44.0	57.5	100.0	152	247	435	1000	1800	
	Air @ 14.7 PSIA (SCFM)	90.0	161.0	205.0	360.0	560	900	1600	3700	6400	
	Air @ 100 PSIG (SCFM)	260.0	460.0	620.0	1050.0	1700	2600	4600	10000	18500	
100	Water (GPM)	36.5	62.0	82.0	142.0	220	350	620	1500		
	Air @ 14.7 PSIA (SCFM)	135.0	230.0	300.0	505.0	800	1290	2290	5000		
	Air @ 100 PSIG (SCFM)	370.0	660.0	870.0	1500.0	2300	3600	6500	15000		

Model A-471 Portable Kit

The Dwyer® Series 4000 Capsuhelic® differential pressure gage is ideally suited for use as a read-out device with the DS-300 Flow Sensors. The gage may be used on system pressures of up to 500 psig even when the flow sensor differential pressure to be read is less than 0.5″ w.c. With accuracy of ±3% of full scale, the Capsuhelic® gage can be used in ambient temperatures from 32 to 200°F (0 to 93.3°C). Zero and range adjustments are made from outside the gage. The standard gage with a die cast aluminum housing can be used with the flow sensor for air or oil applications. For water flow measurements, the optional forged brass housing should be specified. The Capsuhelic® gage may be panel or surface mounted and permanently plumbed to the flow sensor if desired. The optional A-610 pipe mounting bracket allows the gage to be easily attached to any 1-1/4″ - 2″ horizontal or vertical pipe.

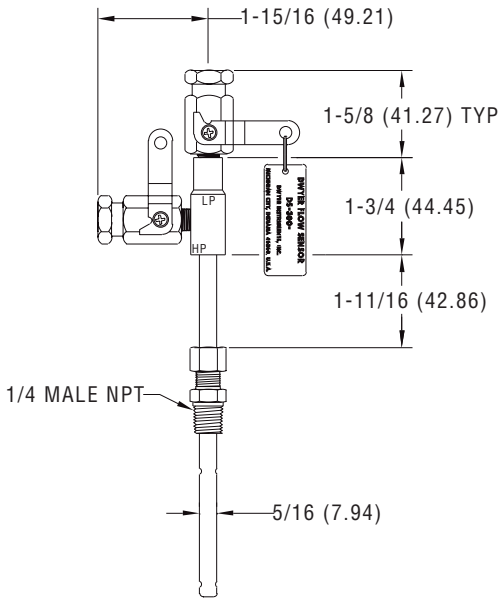
For portable operation, the A-471 Capsuhelic® Portable Gage Kit is available complete with tough polypropylene carrying case, mounting bracket, 3-way manifold valve, two 10' high pressure hoses, and all necessary fittings.

See pages 8 and 9 for complete information on the Capsuhelic® gage **$477.00**

Capsuhelic® Gage Shown Instaled In A-471 Portable Kit

Series DS-300 Flow Sensors

Installation and Operating Instructions Flow Calculations



Series DS-300 Flow Sensors are averaging pitot tubes that provide accurate, convenient flow rate sensing. When purchased with a Dwyer Capsuhelic® for liquid flow or Magnehelic® for air flow, differential pressure gage of appropriate range, the result is a flow-indicating system delivered off the shelf at an economical price. Series DS-300 Flow Sensors are designed to be inserted in the pipeline through a compression fitting and are furnished with instrument shut-off valves on both pressure connections. Valves are fitted with 1/8″ female NPT connections. Accessories include adapters with 1/4″ SAE 45° flared ends compatible with hoses supplied with the Model A-471 Portable Capsuhelic® kit. Standard valves are rated at 200°F (93.3°C). Where valves are not required, they can be omitted at reduced cost. Series DS-300 Flow Sensors are available for pipe sizes from 1″ to 10″.

INSPECTION

Inspect sensor upon receipt of shipment to be certain it is as ordered and not damaged. If damaged, contact carrier.

INSTALLATION

General - The sensing ports of the flow sensor must be correctly positioned for measurement accuracy. The instrument connections on the sensor indicate correct positioning. The side connection is for total or high pressure and should be pointed upstream. The top connection is for static or low pressure.

Location - The sensor should be installed in the flowing line with as much straight run of pipe upstream as possible. A rule of thumb is to allow 10 - 15 pipe diameters upstream and 5 downstream. The table below lists recommended up and down piping.

PRESSURE AND TEMPERATURE

Maximum: 200 psig (13.78 bar) at 200°F (93.3°C).

Upstream and Downstream Dimensions in Terms of Internal Diameter of Pipe*

Upstream Condition	Minimum Diameter of Straight Pipe		
	Upstream		Downstream
	In-Plane	Out of Plane	
One Elbow or Tee	7	9	5
Two 90° Bends in Same Plane	8	12	5
Two 90° Bends in Different Plane	18	24	5
Reducers or Expanders	8	8	5
All Valves**	24	24	5

* Values shown are recommended spacing, in terms of internal diameter for normal industrial metering requirements. For laboratory or high accuracy work, add 25% to values.

** Includes gate, globe, plug and other throttling valves that are only partially opened. If valve is to be fully open, use values for pipe size change. **CONTROL VALVES SHOULD BE LOCATED AFTER THE FLOW SENSOR.**

DWYER INSTRUMENTS, INC.
P.O. BOX 373 • MICHIGAN CITY, INDIANA 46361, U.S.A.
Phone: 219/879-8000 **www.dwyer-inst.com**
Fax: 219/872-9057 **e-mail: info@dwyer-inst.com**

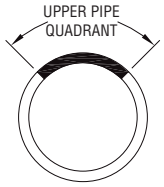
POSITION

Be certain there is sufficient clearance between the mounting position and other pipes, walls, structures, etc, so that the sensor can be inserted through the mounting unit once the mounting unit has been installed onto the pipe.

Flow sensors should be positioned to keep air out of the instrument connecting lines on liquid flows and condensate out of the lines on gas flows. The easiest way to assure this is to install the sensor into the pipe so that air will bleed into, or condensate will drain back to, the pipe.

For Air or Gas Flow

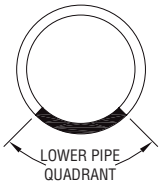
Install in upper quadrant of pipe



Condensate drains back to pipe

For Liquid or Steam Flow

Install in lower quadrant of pipe



Air bleeds back to pipe

INSTALLATION

1. When using an A-160 thred-o-let, weld it to the pipe wall. If replacing a DS-200 unit, an A-161 bushing (1/4˝ x 3/8˝) will be needed.

2. Drill through center of the thred-o-let into the pipe with a drill that is slightly larger than the flow sensor diameter.

3. Install the packing gland using proper pipe sealant. If the packing gland is disassembled, note that the tapered end of the ferrule goes into the fitting body.

4. Insert sensor until it bottoms against opposite wall of the pipe, then withdraw 1/16˝ to allow for thermal expansion.

5. Tighten packing gland nut finger tight. Then tighten nut with a wrench an additional 1-1/4 turns. Be sure to hold the sensor body with a second wrench to prevent the sensor from turning.

INSTRUMENT CONNECTION

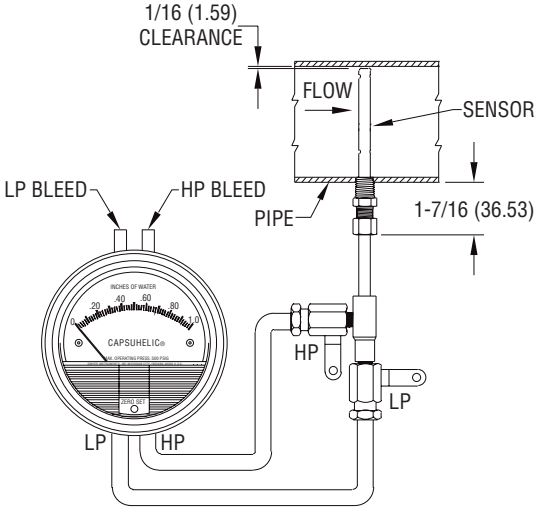
Connect the slide pressure tap to the high pressure port of the Magnehelic® (air only) or Capsuhelic® gage or transmitting instrument and the top connection to the low pressure port.

See the connection schematics below.

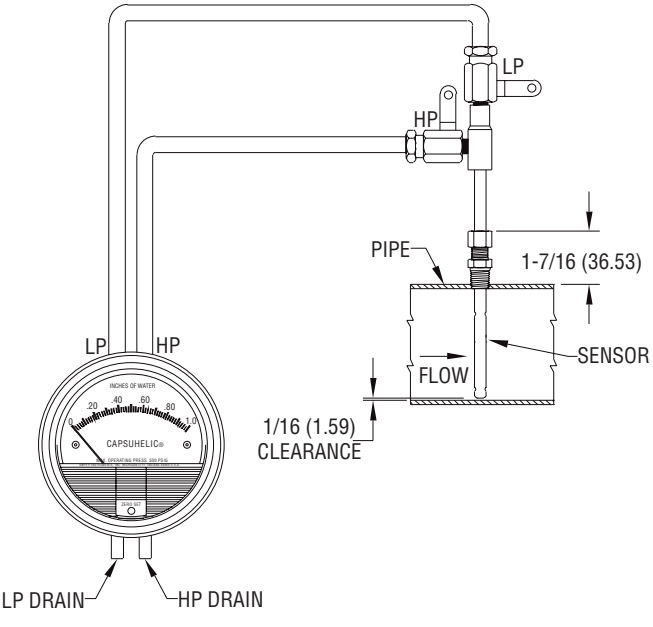
Bleed air from instrument piping on liquid flows. Drain any condensate from the instrument piping on air and gas flows.

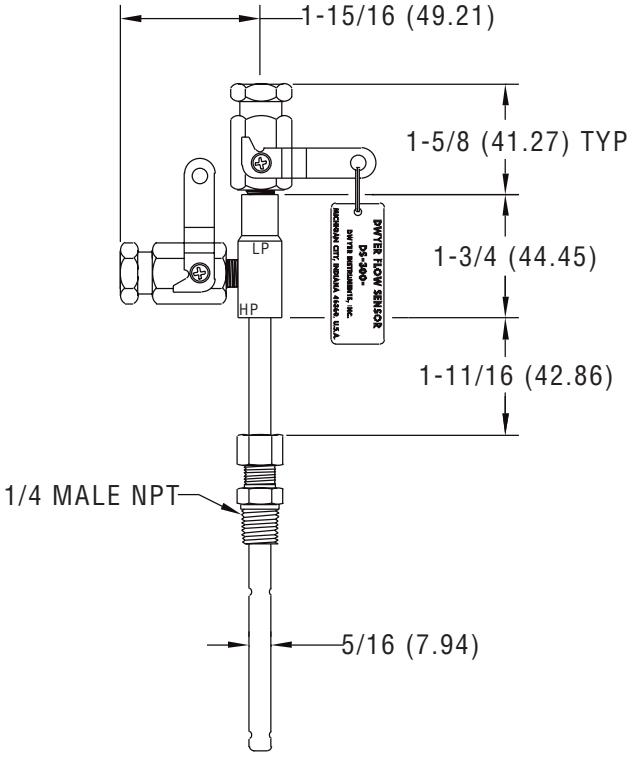
Open valves to instrument to place flow meter into service. For permanent installations, a 3-valve manifold is recommended to allow the gage to be zero checked without interrupting the flow. The Dwyer A-471 Portable Test Kit includes such a device.

Water Flow



Air or Gas Flow





Flow Calculations and Charts

The following information contains tables and equations for determining the differential pressure developed by the DS-300 Flow Sensor for various flow rates of water, steam, air or other gases in different pipe sizes.

This information can be used to prepare conversion charts to translate the differential pressure readings being sensed into the equivalent flow rate. When direct readout of flow is required, use this information to calculate the full flow differential pressure in order to specify the exact range of Dwyer Magnehelic® or Capsuhelic® gage required. Special ranges and calculations are available for these gages at minimal extra cost. See bulletins A-30 and F-41 for additional information on Magnehelic® and Capsuhelic® gages and DS-300 flow sensors.

For additional useful information on making flow calculations, the following service is recommended: Crane Valve Co. Technical Paper No. 410 “Flow of Fluids Through Valves, Fittings and Pipe.” It is available from Crane Valve Company, www.cranevalve.com.

Using the appropriate differential pressure equation from Page 4 of this bulletin,calculate the differential pressure generated by the sensor under normal operating conditions of the system. Check the chart below to determine if this value is within the recommended operating range for the sensor. Note that the data in this chart is limited to standard conditions of air at 60°F (15.6°C) and 14.7 psia static line pressure or water at 70°F (21.1°C). To determine recommended operating ranges of other gases, liquids an/or operating conditions, consult factory.

Note: the column on the right side of the chart which defines velocity ranges to avoid. Continuous operation within these ranges can result in damage to the flow sensor caused by excess vibration.

Pipe Size (Schedule 40)	Flow Coefficient “K”	Operating Ranges Air @ 60°F & 14.7 psia (D/P in. W.C.)	Operating Ranges Water @ 70°F (D/P in. W.C.)	Velocity Ranges Not Recommended (Feet per Second)
1	0.52	1.10 to 186	4.00 to 675	146 to 220
1-1/4	0.58	1.15 to 157	4.18 to 568	113 to 170
1-1/2	0.58	0.38 to 115	1.36 to 417	96 to 144
2	0.64	0.75 to 75	2.72 to 271	71 to 108
2-1/2	0.62	1.72 to 53	6.22 to 193	56 to 85
3	0.67	0.39 to 35	1.43 to 127	42 to 64
4	0.67	0.28 to 34	1.02 to 123	28 to 43
6	0.71	0.64 to 11	2.31 to 40	15 to 23
8	0.67	0.10 to 10	0.37 to 37	9.5 to 15
10	0.70	0.17 to 22	0.60 to 79	6.4 to 10

FLOW EQUATIONS

1. Any Liquid

$$Q\ (GPM) = 5.668 \times K \times D^2 \times \sqrt{\Delta P / S_f}$$

2. Steam or Any Gas

$$Q\ (lb/Hr) = 359.1 \times K \times D^2 \times \sqrt{p \times \Delta P}$$

3. Any Gas

$$Q\ (SCFM) = 128.8 \times K \times D^2 \times \sqrt{\frac{P \times \Delta P}{(T + 460) \times S_s}}$$

DIFFERENTIAL PRESSURE EQUATIONS

1. Any Liquid

$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_f}{K^2 \times D^4 \times 32.14}$$

2. Steam or Any Gas

$$\Delta P\ (in.\ WC) = \frac{Q^2}{K^2 \times D^4 \times p \times 128{,}900}$$

3. Any Gas

$$\Delta P\ (in.\ WC) = \frac{Q^2 \times S_s \times (T + 460)}{K^2 \times D^4 \times P \times 16{,}590}$$

Technical Notations

The following notations apply:

ΔP = Differential pressure expressed in inches of water column
Q = Flow expressed in GPM, SCFM, or PPH as shown in equation
K = Flow coefficient— See values tabulated on Pg. 3.
D = Inside diameter of line size expressed in inches.

For square or rectangular ducts, use: $D = \sqrt{\frac{4 \times \text{Height} \times \text{Width}}{\pi}}$

P = Static Line pressure (psia)
T = Temperature in degrees Fahrenheit (plus 460 = °Rankine)
p = Density of medium in pounds per square foot
S_f = Sp Gr at flowing conditions
S_s = Sp Gr at 60°F (15.6°C)

SCFM TO ACFM EQUATION

$$SCFM = ACFM \times \left(\frac{14.7 + PSIG}{14.7}\right) \left(\frac{520^*}{460 + °F}\right)$$

$$ACFM = SCFM \times \left(\frac{14.7}{14.7 + PSIG}\right) \left(\frac{460 + °F}{520}\right)$$

$$\text{POUNDS PER CUBIC FOOT STD.} = \text{POUNDS PER CUBIC FOOT ACT.} \times \left(\frac{14.7}{14.7 + PSIG}\right) \left(\frac{460 + °F}{520^*}\right)$$

$$\text{POUNDS PER CUBIC FOOT ACT.} = \text{POUNDS PER CUBIC FOOT STD.} \times \left(\frac{14.7 + PSIG}{14.7}\right) \left(\frac{520^*}{460 + °F}\right)$$

1 Cubic foot of air = 0.076 pounds per cubic foot at 60° F (15.6°C) and 14.7 psia.
* (520°= 460 + 60°) Std. Temp. Rankine

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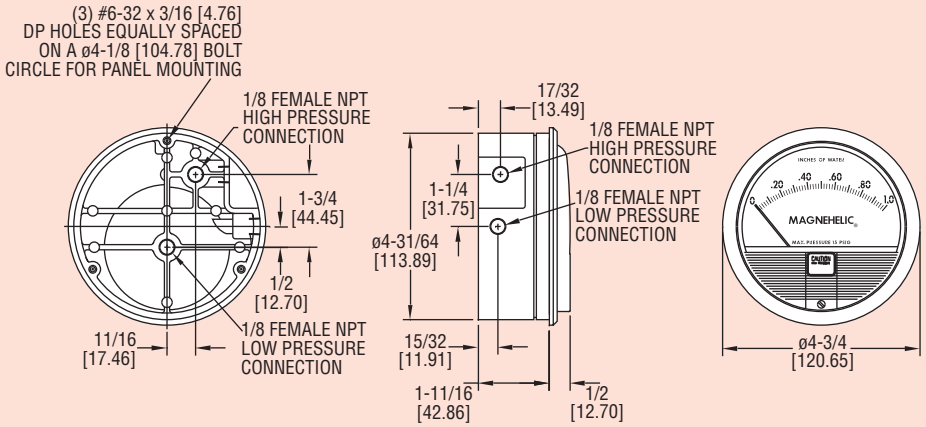
DWYER INSTRUMENTS, INC.
P.O. BOX 373 • MICHIGAN CITY, INDIANA 46361, U.S.A.
Phone: 219/879-8000 www.dwyer-inst.com
Fax: 219/872-9057 e-mail: info@dwyer-inst.com

Series 2000

Magnehelic® Differential Pressure Gages

Indicate Positive, Negative or Differential, Accurate within 2%



Dimensions, Standard Series 2000 Magnehelic® Pressure Gages. (Slightly different on medium and high pressure models)

Select the Dwyer® Magnehelic® gage for high accuracy – guaranteed within 2% of full scale – and for the wide choice of 81 models available to suit your needs precisely. Using Dwyer's simple, frictionless Magnehelic® gage movement, it quickly indicates low air or non-corrosive gas pressures – either positive, negative (vacuum) or differential. The design resists shock, vibration and over-pressures. No manometer fluid to evaporate, freeze or cause toxic or leveling problems. It's inexpensive, too.
The Magnehelic® gage is the industry standard to measure fan and blower pressures, filter resistance, air velocity, furnace draft, pressure drop across orifice plates, liquid levels with bubbler systems and pressures in fluid amplifier or fluidic systems. It also checks gas-air ratio controls and automatic valves, and monitors blood and respiratory pressures in medical care equipment.

Note: May be used with Hydrogen. When ordering a Buna-N diaphragm pressures must be less than 35 psi.

Mounting

A single case size is used for most models of Magnehelic® gages. They can be flush or surface mounted with standard hardware supplied. With the optional **A-610** Pipe Mounting Kit they may be conveniently installed on horizontal or vertical 1-1/4″ - 2″ pipe. Although calibrated for vertical position, many ranges above 1″ may be used at any angle by simply re-zeroing. However, for maximum accuracy, they must be calibrated in the same position in which they are used. These characteristics make Magnehelic® gages ideal for both stationary and portable applications. A 4-9/16″ hole is required for flush panel mounting. Complete mounting and connection fittings plus instructions are furnished with each instrument.

Flush...Surface... or Pipe Mounted

Vent Valves

In applications where pressure is continuous and the Magnehelic® gage is connected by metal or plastic tubing which cannot be easily removed, we suggest using Dwyer A-310A vent valves to connect gage. Pressure can then be removed to check or re-zero the gage.

High and Medium Pressure Models

Installation is similar to standard gages except that a 4-13/16″ hole is needed for flush mounting. The medium pressure construction is rated for internal pressures up to 35 psig and the high pressure up to 80 psig. Available for all models. Because of larger case, the medium pressure and high pressure models will not fit in a portable case size. Installation of the A-321 safety relief valve on standard Magnehelic® gages often provides adequate protection against infrequent overpressure.

SPECIFICATIONS

Service: Air and non-combustible, compatible gases. (Natural Gas option available.)
Wetted Materials: Consult factory.
Housing: Die cast aluminum case and bezel, with acrylic cover. Exterior finish is coated gray to withstand 168 hour salt spray corrosion test.
Accuracy: ±2% of full scale (±3% on - 0, -100 Pa, -125 Pa, 10MM and ±4% on - 00, -60 Pa, -6MM ranges), throughout range at 70°F (21.1°C).
Pressure Limits: -20″ Hg. to 15 psig.† (-0.677 bar to 1.034 bar); MP option: 35 psig (2.41 bar), HP option: 80 psig (5.52 bar).
Overpressure: Relief plug opens at approximately 25 psig (1.72 bar), standard gages only.
Temperature Limits: 20 to 140°F.* (-6.67 to 60°C).
Size: 4″ (101.6 mm) Diameter dial face.
Mounting Orientation: Diaphragm in vertical position. Consult factory for other position orientations.
Process Connections: 1/8″ female NPT duplicate high and low pressure taps - one pair side and one pair back.
Weight: 1 lb 2 oz (510 g), MP & HP 2 lb 2 oz (963 g).
Standard Accessories: Two 1/8″ NPT plugs for duplicate pressure taps, two 1/8″ pipe thread to rubber tubing adapter and three flush mounting adapters with screws. (Mounting and snap ring retainer substituted for 3 adapters in MP & HP gage accessories.)

*Low temperature models available as special option.
†For applications with high cycle rate within gage total pressure rating, next higher rating is recommended. See Medium and High pressure options at lower left.

OPTIONS AND ACCESSORIES

Transparent Overlays
Furnished in red and green to highlight and emphasize critical pressures.

Adjustable Signal Flag
Integral with plastic gage cover. Available for most models except those with medium or high pressure construction. Can be ordered with gage or separate.

LED Setpoint Indicator
Bright red LED on right of scale shows when setpoint is reached. Field adjustable from gage face, unit operates on 12-24 VDC. Requires MP or HP style cover and bezel.

A-432 Portable Kit
Combine carrying case with any Magnehelic® gage of standard range, except high pressure connection. Includes 9 ft (2.7 m) of 3/16″ I.D. rubber tubing, standhang bracket and terminal tube with holder.

A-605 Air Filter Gage Accessory Kit
Adapts any standard Magnehelic® gage for use as an air filter gage. Includes aluminum surface mounting bracket with screws, two 5 ft (1.5 m) lengths of 1/4″ aluminum tubing two static pressure tips and two molded plastic vent valves, integral compression fittings on both tips and valves.

Quality design and construction features

Bezel provides flange for flush mounting in panel.

Clear plastic face is highly resistant to breakage. Provides undistorted viewing of pointer and scale.

Precision litho-printed scale is accurate and easy to read.

Red tipped pointer of heat treated aluminum tubing is easy to see. It is rigidly mounted on the helix shaft.

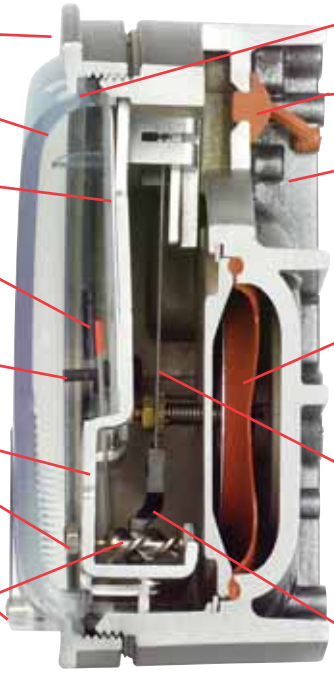
Pointer stops of molded rubber prevent pointer over-travel without damage.

"Wishbone" assembly provides mounting for helix, helix bearings and pointer shaft.

Jeweled bearings are shock-resistant mounted; provide virtually friction-free motion for helix. Motion damped with high viscosity silicone fluid.

Zero adjustment screw is conveniently located in the plastic cover, and is accessible without removing cover. O-ring seal provides pressure tightness.

Helix is precision made from an alloy of high magnetic permeability. Mounted in jeweled bearings, it turns freely, following the magnetic field to move the pointer across the scale.



O-ring seal for cover assures pressure integrity of case.

Blowout plug of silicone rubber protects against overpressure on 15 psig rated models. Opens at approximately 25 psig.

Die cast aluminum case is precision made and iridite-dipped to withstand 168 hour salt spray corrosion test. Exterior finished in baked dark gray hammerloid. One case size is used for all standard pressure options, and for both surface and flush mounting.

Silicone rubber diaphragm with integrally molded O-ring is supported by front and rear plates. It is locked and sealed in position with a sealing plate and retaining ring. Diaphragm motion is restricted to prevent damage due to overpressures.

Calibrated range spring is flat spring steel. Small amplitude of motion assures consistency and long life. It reacts to pressure on diaphragm. Live length adjustable for calibration.

Samarium Cobalt magnet mounted at one end of range spring rotates helix without mechanical linkages.

Series 2000 Magnehelic® Gage — Models and Ranges
Page V shows examples of special models built for OEM customers. For special scales furnished in ounces per square inch, inches of mercury, metric units, square root scales for volumetric flow, etc., contact the factory.

Model	Range Inches of Water
2000-00N†••	.05-0-.2
2000-00†••	0-.25
2000-0†•	0-.50
2001	0-1.0
2002	0-2.0
2003	0-3.0
2004	0-4.0
2005	0-5.0
2006	0-6.0
2008	0-8.0
2010	0-10
2012	0-12
2015	0-15
2020	0-20
2025	0-25
2030	0-30
2040	0-40
2050	0-50
2060	0-60
2080	0-80
2100	0-100
2120	0-120
2150	0-150
2160	0-160
2180	0-180
2250	0-250
Zero Center Ranges	
2300-00†••	0.125-0-0.125
2300-0†•	.25-0-.25
2301	.5-0-.5
2302	1-0-1
2304	2-0-2
2310	5-0-5
2320	10-0-10
2330	15-0-15

Model	Range PSI
2201	0-1
2202	0-2
2203	0-3
2204	0-4
2205	0-5
2210*	0-10
2215*	0-15
2220*	0-20
2230**	0-30

Model	Range, CM of Water
2000-15CM	0-15
2000-20CM	0-20
2000-25CM	0-25
2000-50CM	0-50
2000-80CM	0-80
2000-100CM	0-100
2000-150CM	0-150
2000-200CM	0-200
2000-250CM	0-250
2000-300CM	0-300
Zero Center Ranges	
2300-4CM	2-0-2
2300-10CM	5-0-5
2300-30CM	15-0-15

†These ranges calibrated for vertical scale position.
• Accuracy +/-3%
• • Accuracy +/-4%
*MP option standard
**HP option standard

Model	Range MM of Water
2000-6MM†••	0-6
2000-10MM†•	0-10
2000-15MM	0-15
2000-25MM	0-25
2000-30MM	0-30
2000-50MM	0-50
2000-80MM	0-80
2000-100MM	0-100
2000-125MM	0-125
2000-150MM	0-150
2000-200MM	0-200
2000-250MM	0-250
2000-300MM	0-300
Zero Center Ranges	
2300-6MM†••	3-0-3
2300-10MM†•	5-0-5
2300-20MM†•	10-0-10

Model	Range, Pa
2000-60NPA†••	10-0-50
2000-60PA†••	0-60
2000-100PA†•	0-100
2000-125PA†•	0-125
2000-250PA	0-250
2000-300PA	0-300
2000-500PA	0-500
2000-750PA	0-750
2000-1000PA	0-100 x 10
Zero Center Ranges	
Model	Range, Pa
2300-60PA†••	30-0-30
2300-100PA†•	50-0-50
2300-120PA	60-0-60
2300-200PA	100-0-100
2300-250PA	125-0-125
2300-300PA	150-0-150
2300-500PA	250-0-250
2300-1000PA	500-0-500

Model	Range, kPa
2000-0.5KPA	0-0.5
2000-1KPA	0-1
2000-1.5KPA	0-1.5
2000-2KPA	0-2
2000-2.5KPA	0-2.5
2000-3KPA	0-3
2000-4KPA	0-4
2000-5KPA	0-5
2000-8KPA	0-8
2000-10KPA	0-10
2000-15KPA	0-15
2000-20KPA	0-20
2000-25KPA	0-25
2000-30KPA	0-30
Zero Center Ranges	
2300-1KPA	.5-0-.5
2300-2KPA	1-0-1
2300-2.5KPA	1.25-0-1.25
2300-3KPA	1.5-0-1.5

Dual Scale Air Velocity Units
For use with pitot tube

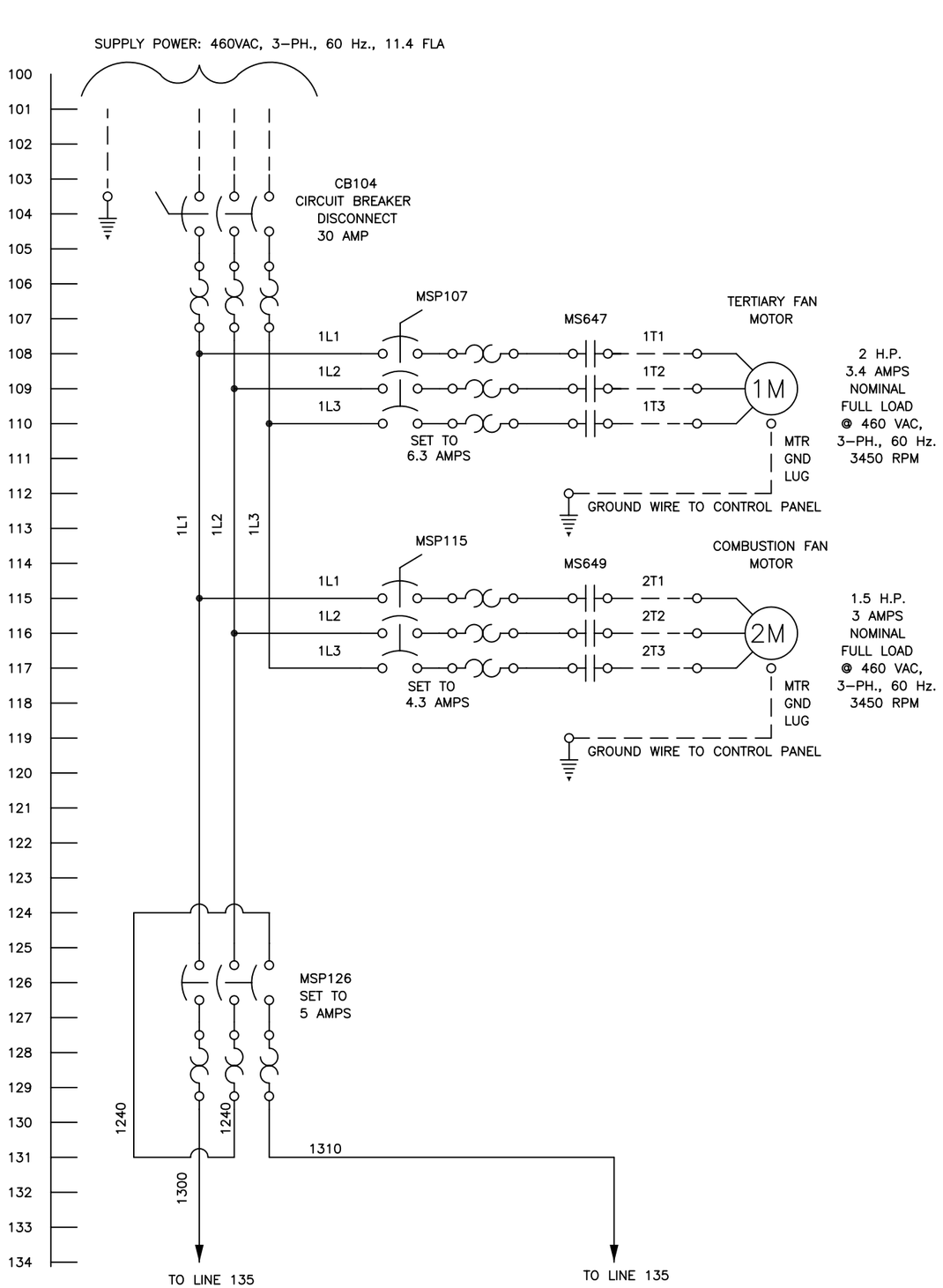
Model	Range in W.C./ Velocity F.P.M.
2000-00AV†••	0-.25/300-2000
2000-0AV†•	0-.50/500-2800
2001AV	0-1.0/500-4000
2002AV	0-2.0/1000-5600
2005AV	0-5.0/2000-8800
2010AV	0-10/2000-12500

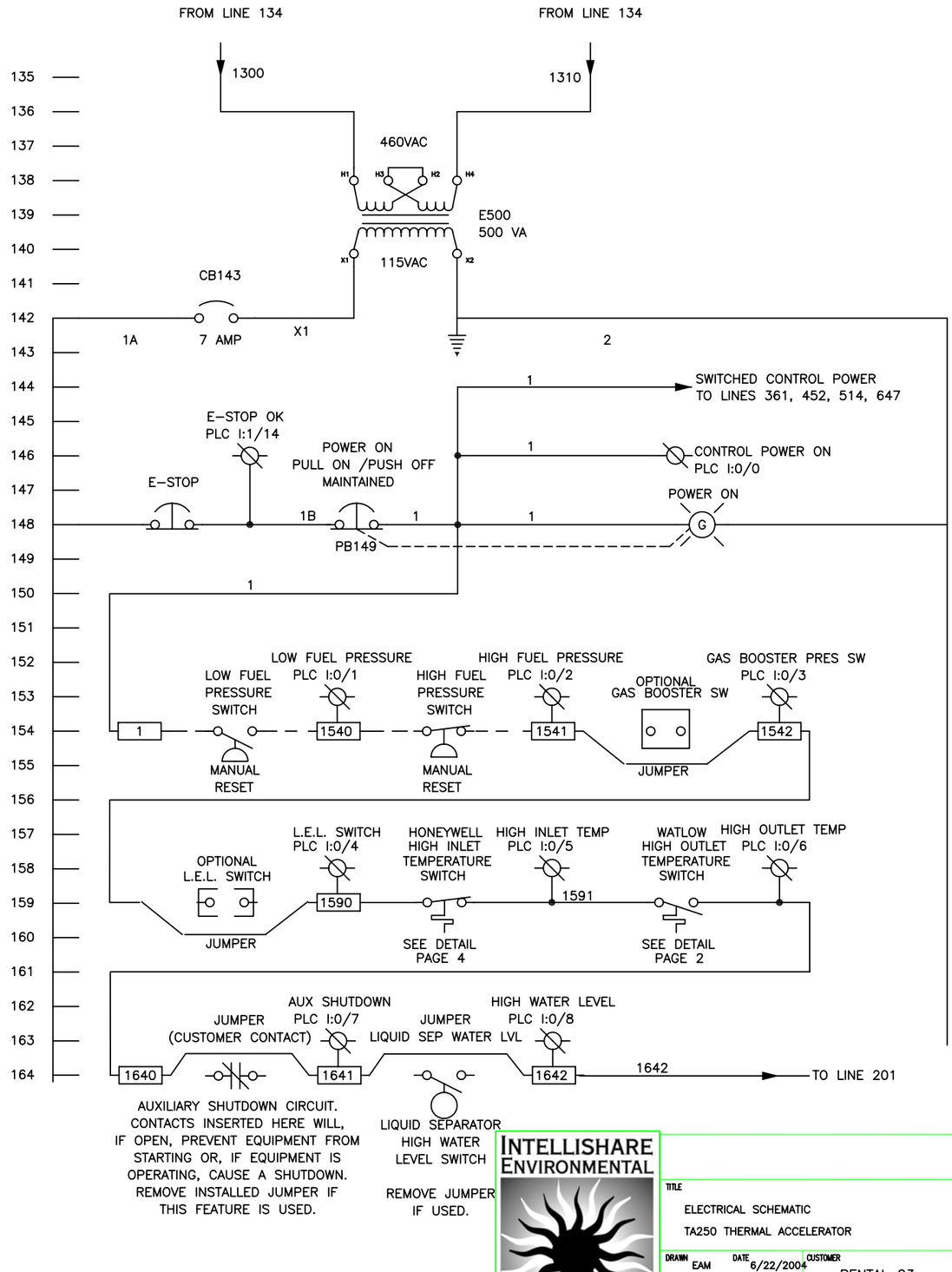
Dual Scale English/Metric Models

Model	Range, In. W.C.	Range, Pa or kPa
2000-OOD†••	0-.25	0-62 Pa
2000-OD†•	0-0.5	0-125 Pa
2001D	0-1.0	0-250 Pa
2002D	0-2.0	0-500 Pa
2003D	0-3.0	0-750 Pa
2004D	0-4.0	0-1.0 kPa
2005D	0-5.0	0-1.25 kPa
2006D	0-6.0	0-1.5 kPa
2008D	0-8.0	0-2.0 kPa
2010D	0-10	0-2.5 kPa
2015D	0-15	0-3.7 kPa
2020D	0-20	0-5 kPa
2025D	0-25	0-6.2 kPa
2050D	0-50	0-12.4 kPa
2060D	0-60	0-15 kPa

ACCESSORIES
A-299, Surface Mounting Bracket
A-300, Flat Flush Mounting Bracket
A-310A, 3-Way Vent Valve
A-321, Safety Relief Valve
A-432, Portable Kit
A-448, 3-piece magnet kit for mounting Magnehelic® gage directly to magnetic surface
A-605, Air Filter Kit
A-610, Pipe Mount Kit

OPTIONS — To order, add suffix: I.E. 2001-ASF
ASF, Adjustable Signal Flag
HP, High Pressure Option
LT, Low Temperatures to -20°F
MP, Med. Pressure Option
SP, Setpoint Indicator
Scale Overlays, Red, Green, Mirrored or Combination, Specify Locations



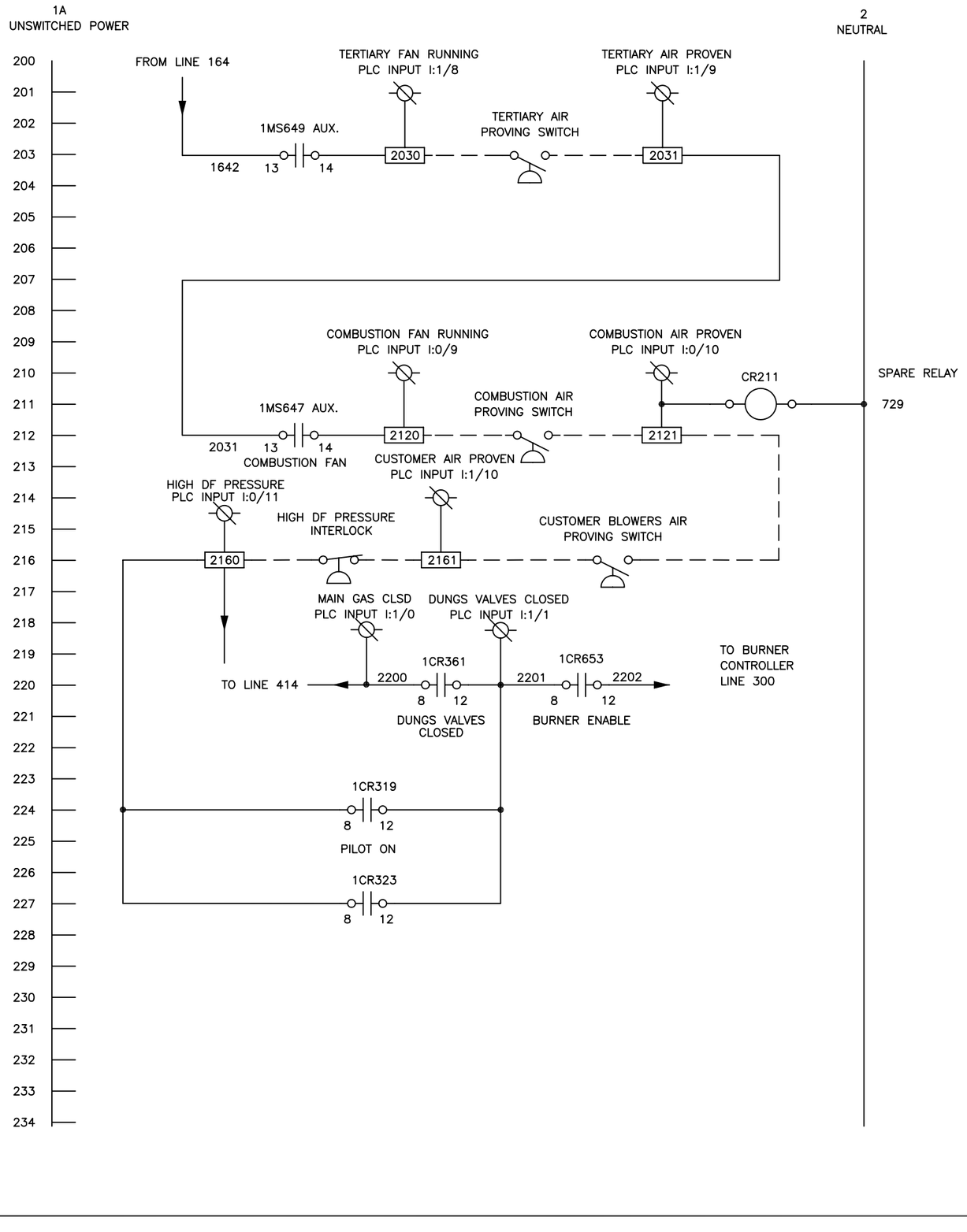


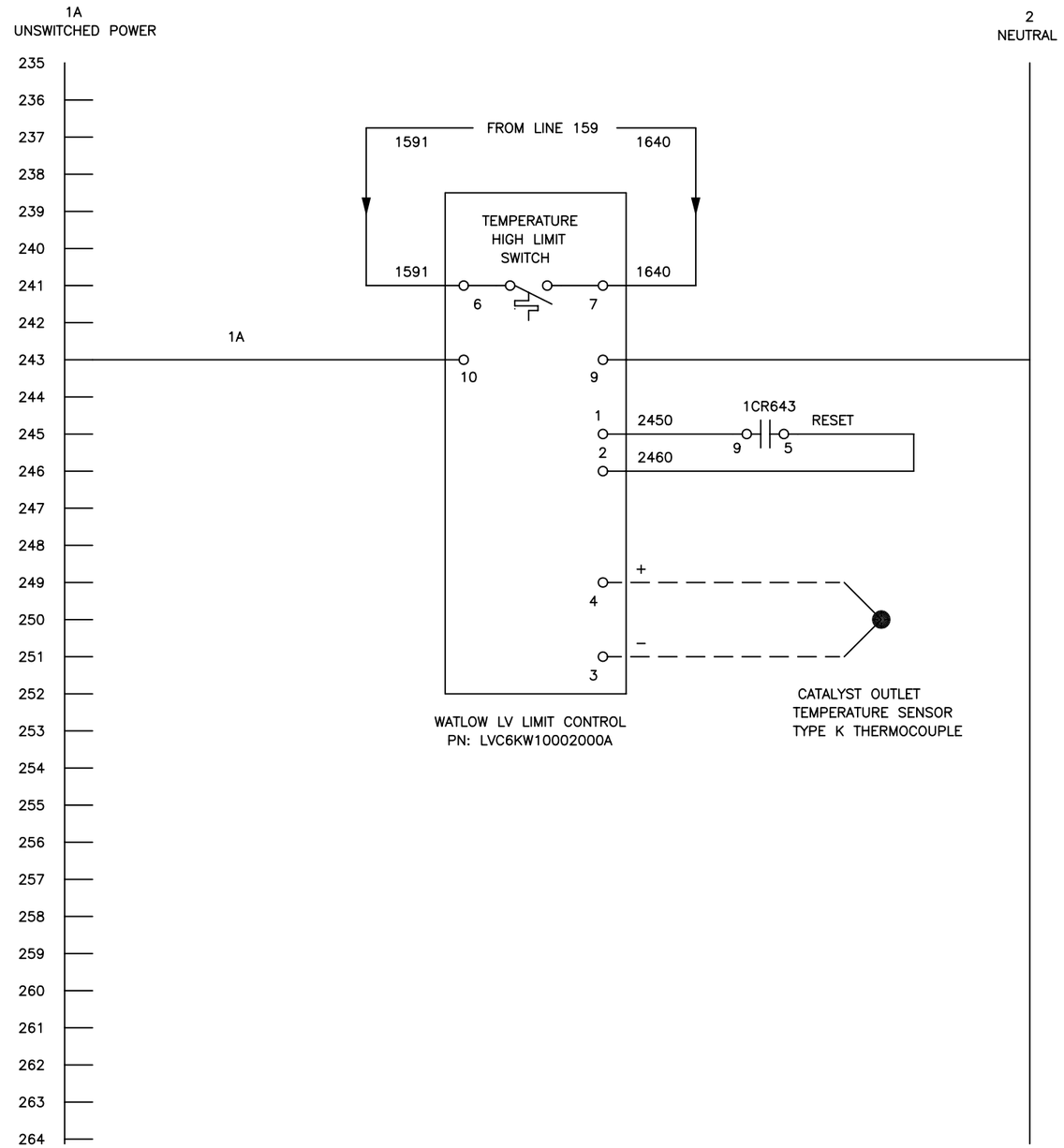
REV	BY	DATE	CHANGE
3	EAM	1/29/2009	CHANGE TO 460V

INTELLISHARE ENVIRONMENTAL
CLEAN AIR SOLUTIONS

TITLE	ELECTRICAL SCHEMATIC TA250 THERMAL ACCELERATOR
DRAWING NO.	N–04–0059–401
SCALE	NONE
DRAWN EAM DATE 6/22/2004	
CHECKED DATE	
APPROVED DATE	
CUSTOMER	RENTAL 23
REV.	—
LAST DRAWN BY EAM DATE 6/22/2004	
SOURCE	
PAGE 1 OF 1	
AUTOCAD PATH	

LAST PLOTTED BY EAM DATE 6/22/2004





REV	BY	DATE	CHANGE
3	EAM	1/29/2009	CHANGE TO 460V

INTELLISHARE ENVIRONMENTAL
CLEAN AIR SOLUTIONS

TITLE	ELECTRICAL SCHEMATIC TA250 THERMAL ACCELERATOR
DRAWING NO.	N-04-0059-402
SCALE	
DRAWN EAM DATE 6/22/2004	CUSTOMER RENTAL 23
CHECKED DATE	REV. —
APPROVED DATE	
LAST DRAWN BY EAM DATE 6/22/2004	SOURCE PAGE 1 OF 1

AUTOCAD PATH

LAST PLOTTED BY EAM DATE 6/22/2004

1A
UNSWITCHED POWER

2202
FROM LINE 220

HONEYWELL RM7895B
FLAME SAFETY CONTROLLER

FSC303

6
BURNER
ENERGIZE

1A

5
LINE POWER

4
COMBUSTION
AIR OUTPUT

7
AIR FLOW
INTERLOCK

LINE
NEUTRAL L2

2

IGNITION
OUTPUT 10

3150

3150

3170

PILOT VALVE
OUTPUT 8

3170

3170

CR319

224

14 13

PILOT ON

MAIN SHUT-OFF
VALVE OUTPUT 9

3210

3210

FLAME FAILURE
ALARM 3

3230

FLAME FAILURE
PLC I:1/2

CR323

227

14 13

FLAME UV
SENSOR F

BLUE

WHITE

UV SENSOR

GND

2
NEUTRAL

IGNITION TRANSFORMER
DONGAN PN: A06-SA6

3150

BLACK

WHITE

2

INSULATOR
BOOT

FEED-THROUGH
INSULATOR

SPARK IGNITOR

2
NEUTRAL

PILOT FUEL
SOLENOID VALVE

3170

2

DUNGS VALVE ASSEMBLY
PN: 224909

BLOCK VALVE
ACTUATOR

3210

2 M 1

2

2

MAIN FUEL VALVE
ACTUATOR

3 M 1

2

3 1

3560

3560

BURNER ON
PLC I:1/3

SWITCH
ON
ACTUATOR

1
FROM LINE 144
SWITCHED POWER

PROOF-OF-CLOSURE

3610

3610

CR361

210

1

3 2

14 13

SWITCH ON VALVE

FUEL CLOSED

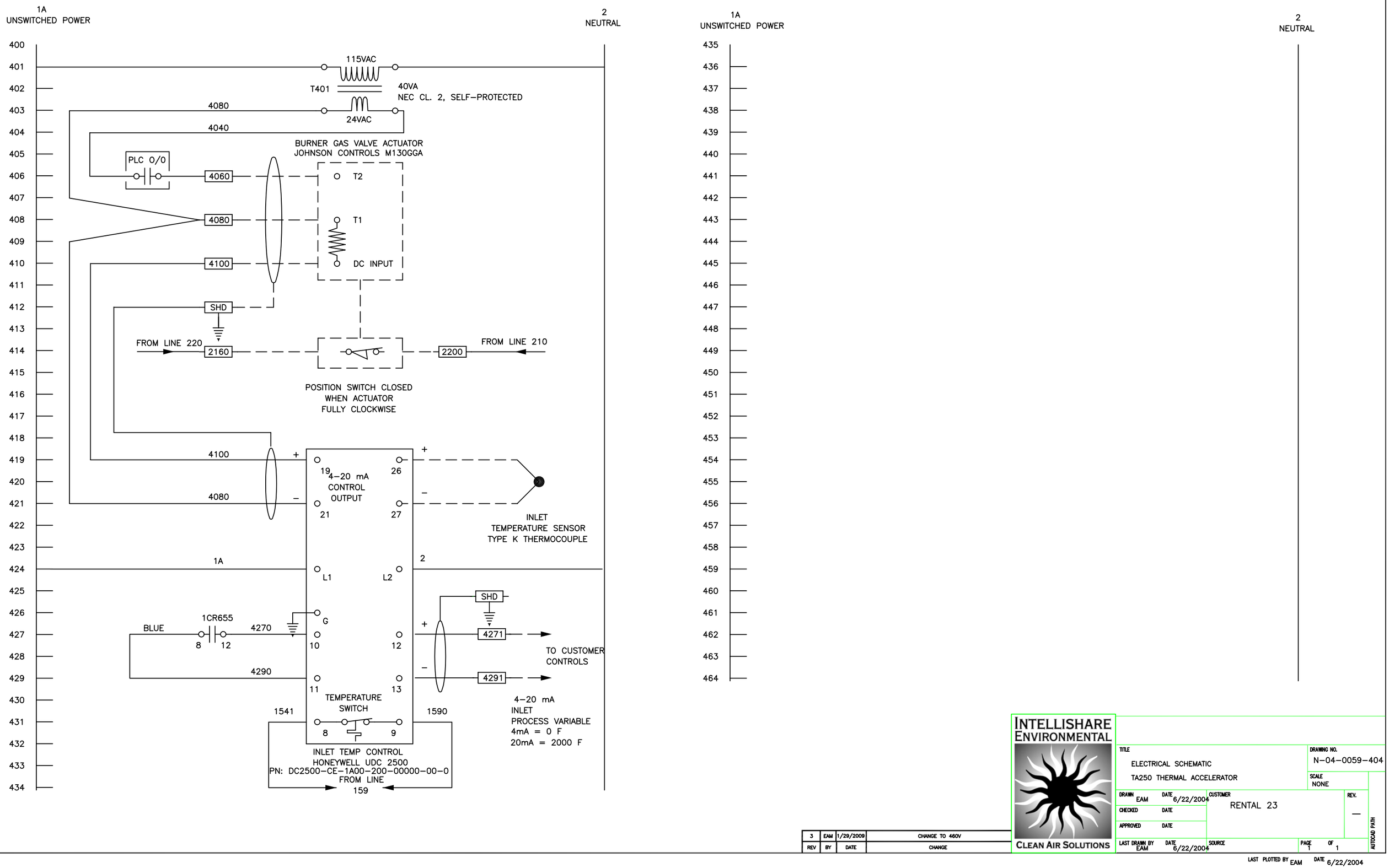
REV	BY	DATE	CHANGE
3	EAM	1/29/2009	CHANGE TO 460V

INTELLISHARE
ENVIRONMENTAL
CLEAN AIR SOLUTIONS

TITLE: ELECTRICAL SCHEMATIC TA250 THERMAL ACCELERATOR			DRAWING NO.: N-04-0059-403
			SCALE:
DRAWN: EAM	DATE: 6/22/2004	CUSTOMER: RENTAL 23	REV.: —
CHECKED	DATE		
APPROVED	DATE		
LAST DRAWN BY: EAM	DATE: 6/22/2004	SOURCE	PAGE 1 OF 1

AUTOCAD PATH

LAST PLOTTED BY EAM DATE 6/22/2004



REV	BY	DATE	CHANGE
3	EAM	1/29/2009	CHANGE TO 460V

INTELLISHARE ENVIRONMENTAL
CLEAN AIR SOLUTIONS

TITLE: ELECTRICAL SCHEMATIC TA250 THERMAL ACCELERATOR			DRAWING NO.: N-04-0059-404
			SCALE: NONE
DRAWN: EAM	DATE: 6/22/2004	CUSTOMER: RENTAL 23	REV.: —
CHECKED	DATE		
APPROVED	DATE		
LAST DRAWN BY: EAM	DATE: 6/22/2004	SOURCE	PAGE: 1 OF 1

AUTOCAD PATH

LAST PLOTTED BY EAM DATE 6/22/2004

1A
UNSWITCHED POWER

2
NEUTRAL

115VAC

T501

40VA
NEC CL. 2, SELF-PROTECTED

24VAC

5080

5040

TERTIARY VALVE ACTUATOR
JOHNSON CONTROLS M130GGA

PLC O/1

5060

T2

5080

T1

5100

DC INPUT

SHD

1

1

5140

FROM LINE 144
SWITCHED CONTROL POWER

POSITION SWITCH CLOSED
WHEN ACTUATOR
FULLY CLOCKWISE

TERTIARY VALVE OPEN
PLC I:1/6

5100

5080

19
4-20 mA
CONTROL
OUTPUT
21

26
27

OUTLET
TEMPERATURE SENSOR
TYPE K THERMOCOUPLE

1A

2

L1

L2

G

SHD

5270

10

12

TO CUSTOMER
CONTROLS

5290

11

13

TEMPERATURE
SWITCH

4 - 20 mA OUTLET
PROCESS VARIABLE
4mA = 0 F
20mA = 2000 F

1A

5310

8

7

SYSTEM READY TEMP
PLC I:1/7

OUTLET TEMP CONTROL
HONEYWELL UDC 2500
PN: DC2500-CE-1A00-200-00000-00-0

1A
UNSWITCHED POWER

2
NEUTRAL

CIRCULAR CHART RECORDER

HONEYWELL DR45AT-1110-00-000-000P00-0

INPUT
BOARD 1

PLUG
J2

MA W1
JUMPER

INLET
TEMPERATURE SIGNAL

INPUT
BOARD 2

PLUG
J2

MA W1
JUMPER

OUTLET
TEMPERATURE SIGNAL

F2

FUSE BLOCK
ON F2
FOR 120 VAC

L1

L2

GND

REV	BY	DATE	CHANGE
3	EAM	1/29/2009	CHANGE TO 460V

INTELLISHARE
ENVIRONMENTAL
CLEAN AIR SOLUTIONS

TITLE
ELECTRICAL SCHEMATIC
TA250 THERMAL ACCELERATOR

DRAWING NO.
N-04-0059-405

SCALE

DRAWN EAM DATE 6/22/2004

CHECKED DATE

APPROVED DATE

CUSTOMER
RENTAL 23

REV.
—

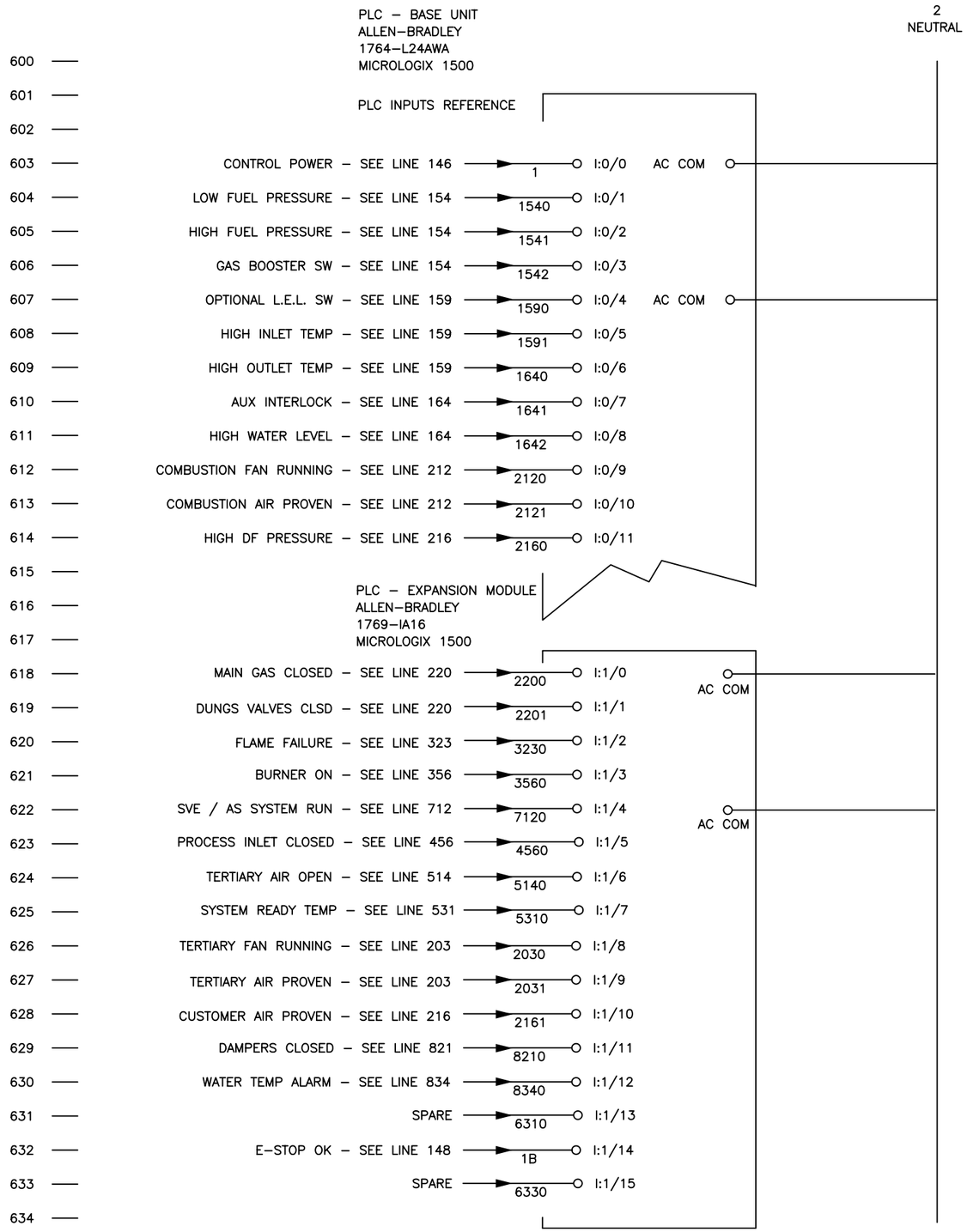
LAST DRAWN BY EAM DATE 6/22/2004

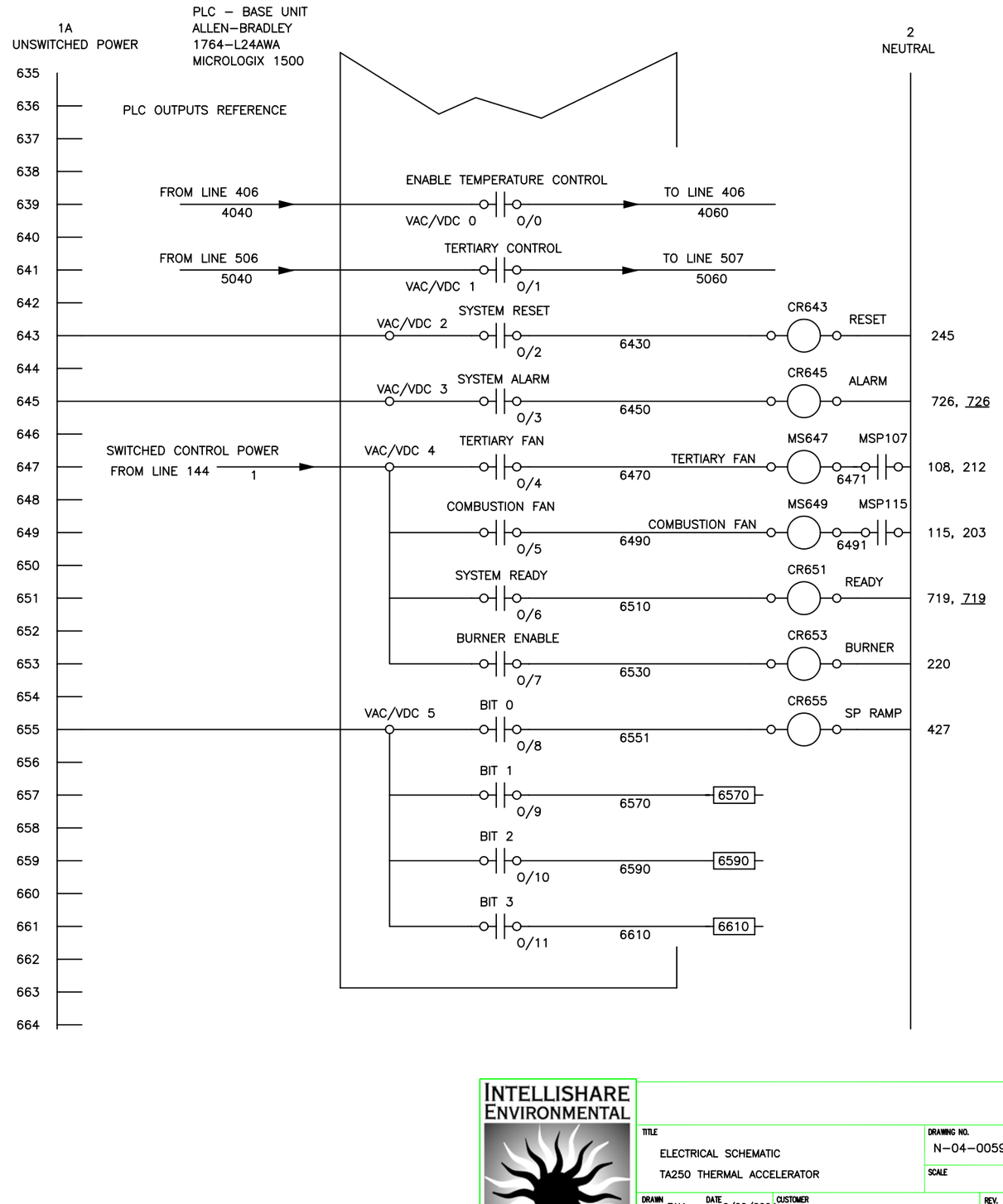
SOURCE

PAGE 1 OF 1

AUTOCAD PATH

LAST PLOTTED BY EAM DATE 6/22/2004





REV	BY	DATE	CHANGE
3	EAM	1/29/2009	CHANGE TO 460V

INTELLISHARE ENVIRONMENTAL
CLEAN AIR SOLUTIONS

TITLE	ELECTRICAL SCHEMATIC TA250 THERMAL ACCELERATOR
DRAWING NO.	N–04–0059–406
SCALE	
DRAWN EAM DATE 6/22/2004	CUSTOMER RENTAL 23
REV.	—
CHECKED DATE	
APPROVED DATE	
LAST DRAWN BY EAM DATE 6/22/2004	SOURCE
PAGE 1 OF 1	
AUTOCAD PATH	

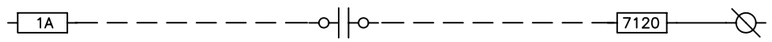
LAST PLOTTED BY EAM DATE 6/22/2004

1A
UNSWITCHED POWER

2
NEUTRAL

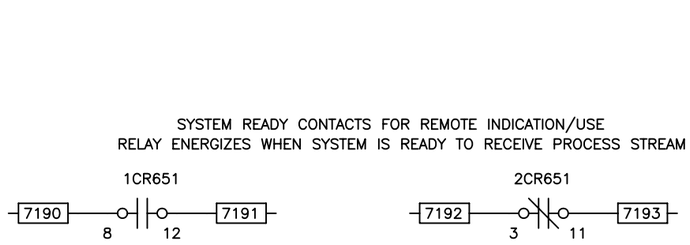
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734

SVE / AS SYSTEM RUNNING CONTACT
DRY CONTACT IN SVE / AS PANEL IS CLOSED WHEN SYSTEM IS RUNNING

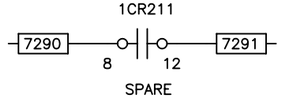


SVE/AS RUNNING
PLC I:1/4

SYSTEM READY CONTACTS FOR REMOTE INDICATION/USE
RELAY ENERGIZES WHEN SYSTEM IS READY TO RECEIVE PROCESS STREAM



SYSTEM ALARM CONTACTS FOR REMOTE INDICATION/USE
RELAY ENERGIZES WHEN SYSTEM IS IN ALARM.



SPARE

1A
UNSWITCHED POWER

2
NEUTRAL

735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
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756
757
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759
760
761
762
763
764

1A

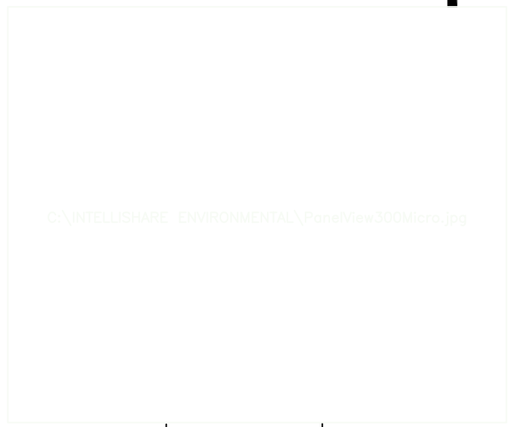
ALLEN–BRADLEY
1764–24AWA
MICROLOGIX 1500
PLC

120/240 VAC
VAC NEUT
AC COMM
GND

2

COMMUNICATION PORT
RS232 PORT

ALLEN–BRADLEY PANELVIEW 300 MICRO
PN: 2711–M3A18L1



24+
24–

SOLA 24VDC POWER SUPPLY
PN: SDP1–24–100

DUPLEX RECEPTACLE

REV	BY	DATE	CHANGE
3	EAM	1/29/2009	CHANGE TO 460V

INTELLISHARE ENVIRONMENTAL
CLEAN AIR SOLUTIONS

TITLE
ELECTRICAL SCHEMATIC
TA250 THERMAL ACCELERATOR

DRAWING NO.
N–04–0059–407

SCALE

DRAWN EAM DATE 6/22/2004
CHECKED DATE
APPROVED DATE
LAST DRAWN BY EAM DATE 6/22/2004

CUSTOMER
RENTAL 23

REV.
—

SOURCE

PAGE 1 OF 1

AUTOCAD PATH

LAST PLOTTED BY EAM DATE 6/22/2004

NOTE: OUTER DOOR IS SHOWN OPEN.

ITEM	QTY.	DESCRIPTION	PART NUMBER	MFG.
1	1	ENCLOSURE – 30" x 30" x 12"	C–SD303012	HOFFMAN
2	1	SUBPANEL – 28" x 28"	C–P3030	HOFFMAN
3	1	SWINGOUT KIT – 28" x 28"	C–SP3030	HOFFMAN
4	1	CONTROL TRANSFORMER 460/230–115, 500VA	E500	HEVI–DUTY
5	2	CONTROL TRANSFORMER 120–24VAC, 40VA 90–T40F3	3TZ67	WHITE RODGERS
6	2	MOTOR CIRCUIT PROTECTOR 4–6.3A	140M–C2E–B63	A–B
7	1	CIRCUIT BREAKER 7A, 1P	FAZ–7–NA	MOELLER
8	1	CIRCUIT BREAKER 30A, 600V, 3P	FAL34030	SQUARED
9	1	CIRCUIT BREAKER OPEARTING MECHANISM	9421LN3	SQUARED
10	1	CONTACTOR	100–C12D10	A–B
11	1	MOTOR CIRCUIT PROTECTOR 6.3–10A	140M–C2E–C10	A–B
12	2	MOTOR CIRCUIT PROTECTOR AUX CONTACT	140M–C–AFA10	A–B
13	1	DUPLEX RECEPTICLE	5320–ICP	LEVITON
14	1	DUPLEX COVER	58C7	STEEL CITY
15	1	HANDY BOX	58361–1/2	STEEL CITY
16	6	CONTROL RELAY – 4 POLE	RY4S–UL–120V	IDEC
17	6	CONTROL RELAY BASE – 4 POLE	SY4S–05	IDEC
18	1	24 VDC POWER SUPPLY	PS5R–C24	IDEC
19	1	PANELVIEW 300 MESSAGE DISPLAY	2711–M3A18L1	A–B
20	1	MESSAGE DISPLAY CABLE	1761–CBL–HM02	A–B
21	6	CUSTOM DEVICE TAG	TAG–CUS	CUSTOM ENGRAVING
22	1	WARNING LABEL	CUSTOM	CUSTOM ENGRAVING
23	1	CHART RECORDER, DR45AT–1100–00–000–0–000P00–0		HONEYWELL
24	1	HIGH TEMPERATURE SWITCH – LV	LVC6KW10002000A	WATLOW
25	2	TEMPERATURE CONTROLLER	DC230B–CE–2A–10	HONEYWELL
26				
27	60	TERMINAL BLOCK	115116.07	ENTERLEC
28	6	TERMINAL END BARRIER	118368.16	ENTRELEC
29	2	TERMINAL BLOCK JUMPER	168517.26	ENTERLEC
30	1	TERMINAL BLOCK JUMPER	168516.25	ENTERLEC
31	1	TERMINAL BLOCK – GROUNDING	165113.16	ENTERLEC
32	8	DIN RAIL END CLAMP	BNL5	IDEC
33	1	35MM DIN RAIL – SHALLOW	173220.05	ENTERLEC
34	1	35MM DIN RAIL – DEEP	101598.26	ENTERLEC
35				
36	1	GROUND LUG	L70	CONNECTOR MFG
37	1	ILLUMINATED PB	800EM–LMP23	A–B
38	1	WIREWAY	G1X2WH6	PANDUIT
39	1	WIREWAY COVER	C1WH6	PANDUIT
40	2	DIN RAIL STANDOFF	008521.26	ENTRELEC
41	1	PB LED	800E–3N5G	A–B
42	1	E–STOP OPERATOR	800EM–MP24	A–B
43	2	E–STOP & PB CONTACTS	800E–3LX01	A–B
44	1	FLAME SAFEGUARD	RM7895B–1013	HONEYWELL
45	1	FLAME SAFEGUARD MOUNTING BASE	Q7800A–1005	HONEYWELL
46	1	FLAME STRENGTH AMPLIFIER	R7847A–1033	HONEYWELL
47	1	FLAME SAFEGUARD DISPLAY	S7800A–1001	HONEYWELL
48	1	PRE–PURGE TIMER 90 SEC.	ST7800A–1001	HONEYWELL
49	1	FLAME SAFEGUARD DISPLAY CABLE	221818A	HONEYWELL
50	1	FLAME SAFEGUARD DISPLAY COVER	204718A	HONEYWELL
51	1	PLC BASE UNIT	1764–24AWA	A–B
52	1	PLC CPU	1764–LRP	A–B
53	1	PLC INPUT MODULE	1769–IA16	A–B
54	1	PLC END CAP	1769–ECR	A–B
55	1	E–STOP LEGEND	800E–15YE112	A–B
56				
57				
58				

A CHART RECORDER (21)

B MESSAGE DISPLAY (21)

C FLAME SAFETY (21)

D CONTROL POWER PULL ON/PUSH OFF (21)

E MAIN DISCONNECT (21)

F

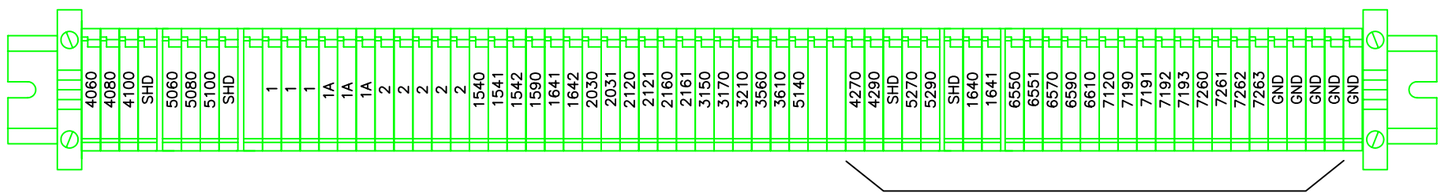
G INLET TEMPERATURE (21)

H OUTLET TEMPERATURE (21)

CAUTION (22)

FOREIGN VOLTAGES MAY BE PRESENT. DISCONNECT ALL SOURCES BEFORE SERVICING.

ENLARGED VIEW OF TERMINAL BLOCKS



TO CUSTOMER CONTROLS

REV	BY	DATE	CHANGE
3	EAM	1/29/2009	CHANGE TO 460V

INTELLISHARE ENVIRONMENTAL

CLEAN AIR SOLUTIONS

TITLE: ELECTRICAL SCHEMATIC TA250 THERMAL ACCELERATOR		DRAWING NO.: N–04–0059–450
		SCALE: NONE
DRAWN: EAM DATE: 6/22/2004	CUSTOMER: RENTAL 23	REV.: —
CHECKED DATE		
APPROVED DATE		
LAST DRAWN BY: EAM DATE: 6/22/2004	SOURCE	PAGE: 1 OF 1

AUTOCAD PATH

LAST PLOTTED BY EAM DATE 6/22/2004

Wiring Instructions/Information

Field Connection	Terminal Strip	Function Text
Y	1	Low Fuel Pressure SW – Common
Y	1540	Low Fuel Pressure SW – Return
Y	1540	High Fuel Pressure SW – Common
Y	1541	High Fuel Pressure SW – Return
O	1541	Gas Booster SW – Common (Optional)
O	1542	Gas Booster SW – Return (Optional)
O	1542	L.E.L. SW – Common (Optional)
O	1590	L.E.L. SW – Return (Optional)
O	1640	Aux Shut Down – Common (Optional)
O	1641	Aux Shut Down – Return (Optional)
O	1641	High Water Level SW – Common (Optional)
O	1642	High Water Level SW – Return (Optional)
Y	2030	Tertiary Air SW – Common
Y	2031	Tertiary Air SW – Return
Y	2120	Combustion Air SW – Common
Y	2121	Combustion Air SW – Return
Y	2121	Customer Blowers Air SW – Common
Y	2121	Customer Blowers Air SW – Return
Y	2161	Catalyst Differential Pressure SW – Common
Y	2161	Catalyst Differential Pressure SW – Return
Y	3150	Ignition Transformer – Black Wire
Y	2	Ignition Transformer – White Wire
Y	3170	Pilot Solenoid Valves – Red Wire
Y	2	Pilot Solenoid Valves – Red Wire
Y	2	Blocking & Main Gas Valve Actuator Terminal #1
Y	3210	Blocking & Main Gas Valve Actuator Terminal #2
Y	3210	Blocking & Main Gas Valve Actuator Terminal #3
Y	1	Gas Valve SW – Common – Terminal #3
Y	3560	Gas Valve SW – Return – Terminal #1
Y	3610	Gas Valve SW – Return – Terminal #2
Y	2160	Gas Valve Actuator – Common
Y	2200	Gas Valve Actuator – Return
Y	1	Tertiary Valve SW – Common
Y	5140	Tertiary Valve SW – Return
Y	1	HX1 Damper Closed SW – Common
Y	8120	HX1 Damper Closed SW – Return
Y	8120	HX2 Damper Closed SW – Common
Y	8210	HX2 Damper Closed SW – Return

Terminal Block TB1 (Control Voltage)

Terminal block "TB1" represents all Control Voltage terminal connections. The "Field Conn." column is marked with an "Y" to identify required field connections, and an "O" for optional connections.

All wiring shall be RED 14 guage type THHN and must be isolated from low voltage wiring.

Warning: Follow appropriate guidlines when wiring to classified environment.

Field Connection	Terminal Strip	Function Text
Y	4060	Gas Valve Actuator – 24V
Y	4080	Gas Valve Actuator – Analog Command (–)
Y	4100	Gas Valve Actuator – Analog Command (+)
Y	5060	Tertiary Valve Actuator – 24V
Y	5080	Tertiary Valve Actuator – Analog Comman (–)
Y	5100	Tertiary Valve Actuator – Analog Command (+)
Y	8060	HX1 Damper Actuator – 24V
Y	8080	HX1 Damper Actuator – Analog Comman (–)
Y	8100	HX1 Damper Actuator – Analog Command (+)
Y	8060	HX2 Damper Actuator – 24V
Y	8080	HX2 Damper Actuator – Analog Comman (–)
Y	8100	HX2 Damper Actuator – Analog Command (+)

Terminal Block TB2 (Low Voltage)

Terminal block "TB2" represents all Low Voltage terminal connections. The "Field Conn." column is marked with an "Y" to identify required field connections, and an "O" for optional connections.

All wiring shall be 18 AWG 3 conductor shielded belden cable or equivilent and must be isolated from high voltage wiring.

Warning: Follow appropriate guidlines when wiring to classified environment.

INCOMING POWER – 460V, 3 Phase

Incoming power shall be wired to the Fuse Block provided, see schematic line #101.
Wire must be sized to meet NEC & Local code requirements.

MOTOR CONNECTIONS

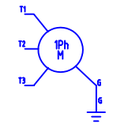
All field wiring for motors shall be black in color and sized to meet local and NEC requirements.

Connections are to be made directly from motor to overload block as shown on page 401 of the schematic.

All motor ground connections are to be connected to ground bar on panel.

Always isolate from any low voltage wiring.

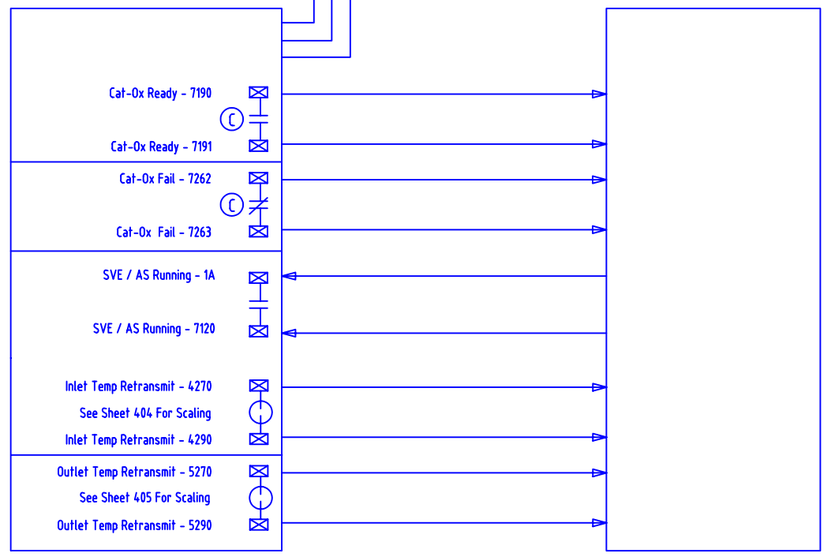
The motors to be wired are shown below:



MTR	VOLTS	AMPS	WIRE
M1	460/3	3.4A	14AWG
M2	460/3	3A	14AWG

INTERFACE WIRING

xx Run 4 spare red 14AWG wires



REV	BY	DATE	CHANGE
3	EAM	1/29/2009	CHANGE TO 460V

INTELLISHARE ENVIRONMENTAL
CLEAN AIR SOLUTIONS

TITLE: ELECTRICAL SCHEMATIC
TA250 THERMAL ACCELERATOR

DRAWING NO.: N–04–0059–451
SCALE: NONE
DRAWN: EAM DATE: 6/22/2004
CHECKED: DATE:
APPROVED: DATE:
CUSTOMER: RENTAL 23
REV.: —
LAST DRAWN BY: EAM DATE: 6/22/2004
SOURCE:
PAGE: 1 OF 1
AUTOCAD PATH:

LAST PLOTTED BY EAM DATE 6/22/2004

SUPPLY POWER: 460VAC, 3–PH., 60 Hz., 28 FLA
40 AMP BRANCH CIRCUIT PROTECTION BY OTHERS

DISCONNECT

MSP105
MS636
SVE
BLOWER MOTOR
1M
15 H.P.
18 FLA AMPS
NOMINAL
FULL LOAD
@ 460 VAC,
3–PH., 60 Hz.
3450 RPM
SET TO
18 AMPS
MTR
GND
LUG
GROUND WIRE TO CONTROL PANEL

MSP116
MS642
COMBUSTION FAN
BLOWER MOTOR
2M
3 H.P.
3.6 FLA AMPS
NOMINAL
FULL LOAD
@ 460 VAC,
3–PH., 60 Hz.
3450 RPM
SET TO
3.6 AMPS
MTR
GND
LUG
GROUND WIRE TO CONTROL PANEL

MSP127
MS638
TRANSFER
PUMP MOTOR
3M
1 H.P.
1.4 FLA AMPS
NOMINAL
FULL LOAD
@ 460 VAC,
3–PH., 60 Hz.
3450 RPM
SET TO
1.4 AMPS
MTR
GND
LUG
GROUND WIRE TO CONTROL PANEL

CB152
5 AMPS
1560
1561
TO LINE 201

REV	BY	DATE	CHANGE
0	EAM	1/5/10	Submittal

INTELLISHARE ENVIRONMENTAL
CLEAN AIR SOLUTIONS

PROJECT ID

TITLE
ELECTRICAL SCHEMATIC
TO 500

DRAWING NO.
N–09–0958 –401

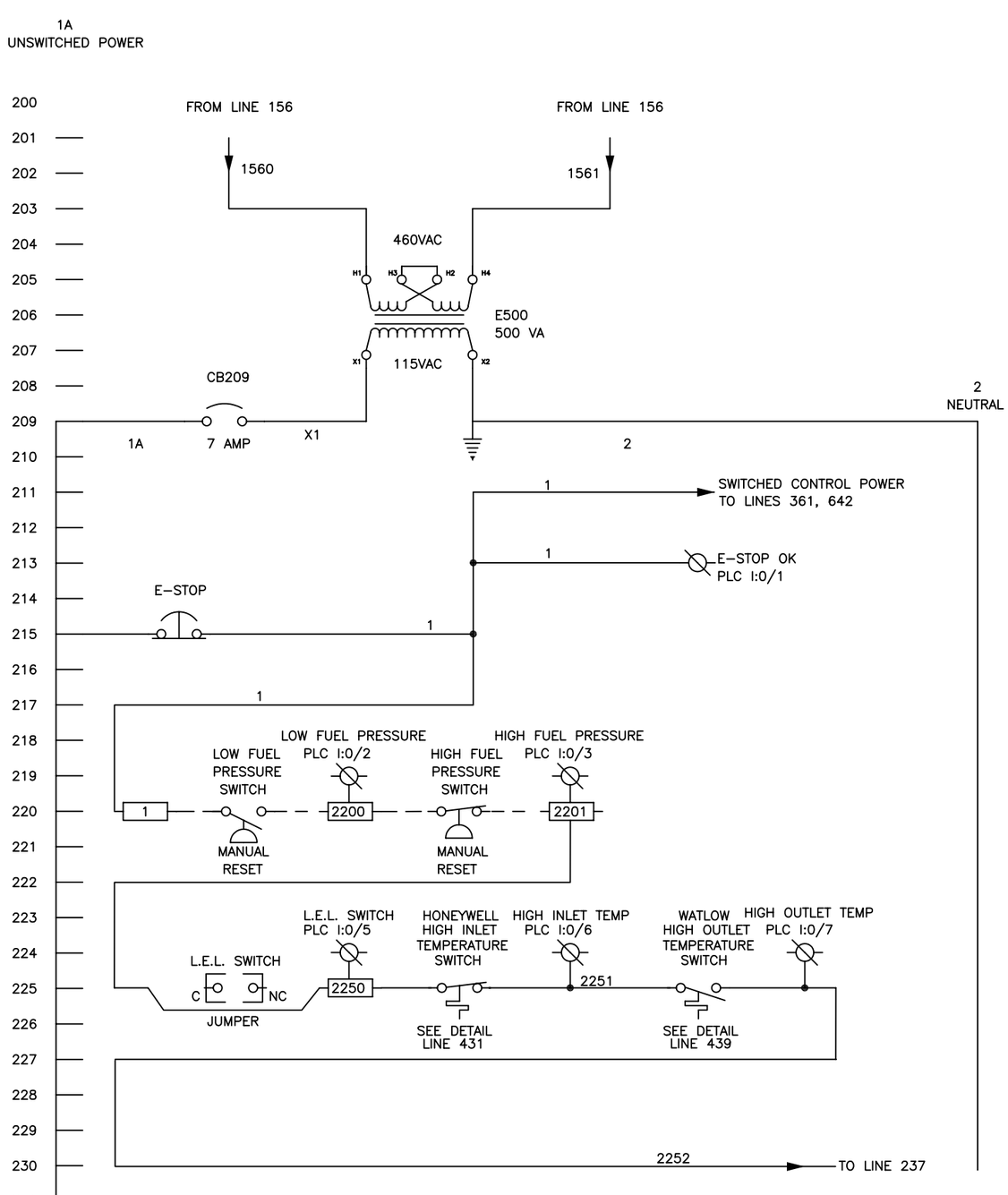
SCALE
NONE

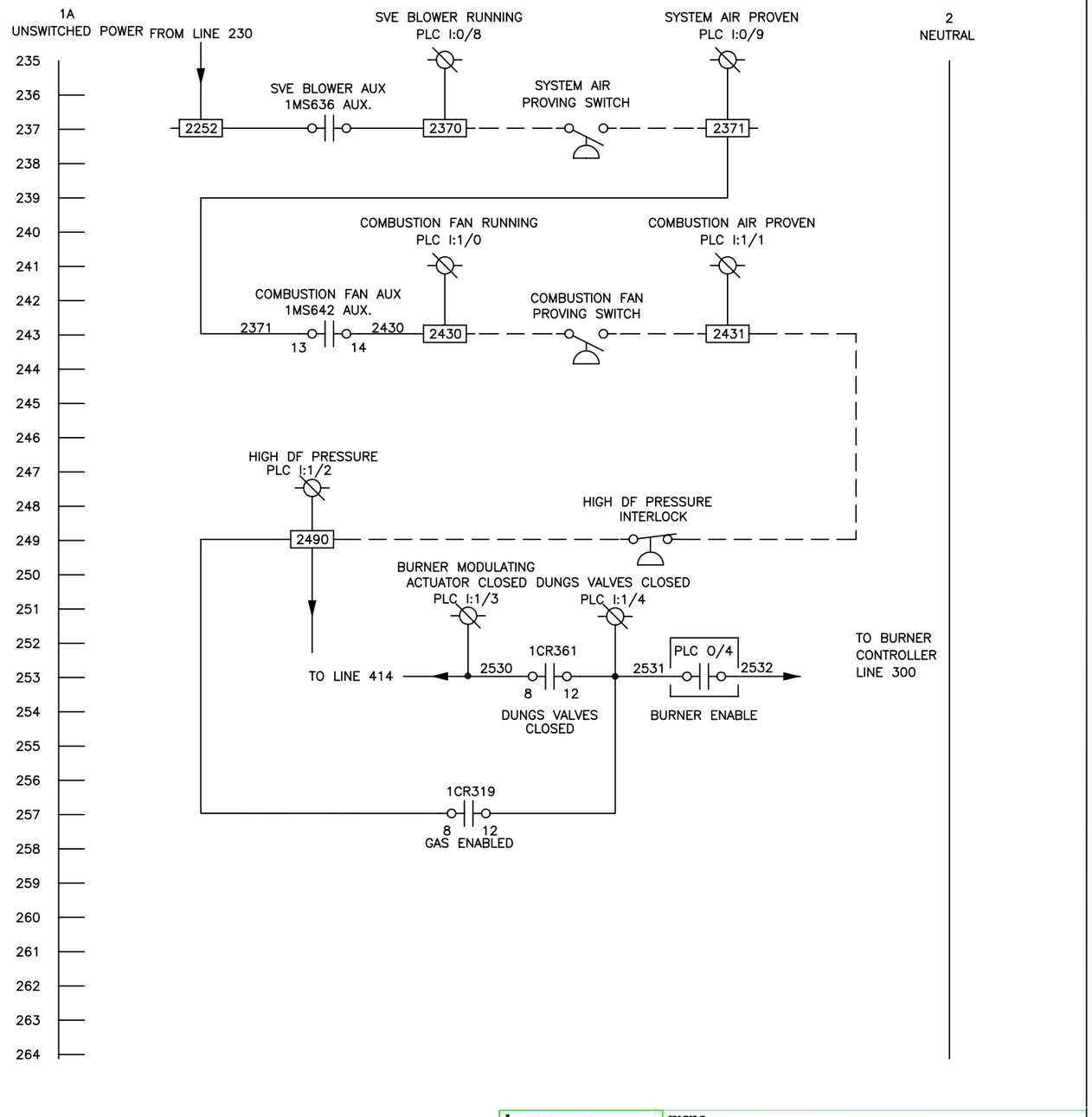
DRAWN EAM DATE 1/5/10
CHECKED DATE
APPROVED DATE
LAST DRAWN BY EAM DATE 1/5/10

CUSTOMER
DP Stephens

KF NUMBER 10104
PAGE 1 OF 1

LAST PLOTTED BY EAM DATE 1/5/10





REV	BY	DATE	CHANGE
0	EAM	1/5/10	Submittal

INTELLISHARE ENVIRONMENTAL
CLEAN AIR SOLUTIONS

PROJECT ID

TITLE
ELECTRICAL SCHEMATIC
TO 500

DRAWING NO.
N-09-0958-402

SCALE
NONE

DRAWN EAM DATE 1/5/10

CHECKED DATE

APPROVED DATE

CUSTOMER
DP Stephens

LAST DRAWN BY EAM DATE 1/5/10

KF NUMBER 10104

PAGE 1 OF 1

LAST PLOTTED BY EAM DATE 1/5/10

1A
UNSWITCHED POWER

2
NEUTRAL

2
NEUTRAL

2532
FROM LINE 253

HONEYWELL RM7895B
FLAME SAFETY CONTROLLER

RESET MODULE

R640
3030
3031

6
BURNER
ENERGIZE

1A
5
LINE POWER

UV SCANNER
I
+
3080
TO LINE 610
3100
TO LINE 611

4
COMBUSTION
AIR OUTPUT
7
AIR FLOW
INTERLOCK

LINE
NEUTRAL L2
2

IGNITION
OUTPUT
10
3150
3150

PILOT VALVE
OUTPUT
8
3170
3170

CR319
14 13
257
GAS ENABLED

MAIN SHUT-OFF
VALVE OUTPUT
9
3210
1CR363
8 12
FUEL OPEN
3211
BURNER ON
PLC I:1/6

FLAME FAILURE
ALARM
3
3230
FLAME FAILURE
PLC I:1/5
MANUAL RESET

FLAME UV
SENSOR
F
BLUE
WHITE
UV SENSOR

GND

IGNITION TRANSFORMER
DONGAN PN: A06-SA6X
3150
BLACK
WHITE
2
INSULATOR
BOOT
FEED-THROUGH
INSULATOR
SPARK IGNITOR

DUNGS VALVE ASSEMBLY
PN: 230791
BLOCK VALVE
ACTUATOR
3170
2 M 1
2
2

MAIN FUEL VALVE
ACTUATOR
3 M 1
2

N
S

BLOCKING VALVE
CLOSED LIMIT SWITCH

1
FROM LINE 144
SWITCHED POWER
1

3590
CR361
14 13
210
FUEL CLOSED

3630
3630
CR363
14 13
321
FUEL OPEN

REV	BY	DATE	CHANGE
0	EAM	1/5/10	Submittal

INTELLISHARE
ENVIRONMENTAL
CLEAN AIR SOLUTIONS

PROJECT ID

TITLE
ELECTRICAL SCHEMATIC
TO 500

DRAWING NO.
N-09-0958 -403

SCALE
NONE

DRAWN EAM DATE 1/5/10
CHECKED DATE
APPROVED DATE

CUSTOMER
DP Stephens

LAST DRAWN BY EAM DATE 1/5/10
KF NUMBER 10104
PAGE 1 OF 1

LAST PLOTTED BY EAM DATE 1/5/10

1A
UNSWITCHED POWER

2
NEUTRAL

BURNER MODULATING VALVE ACTUATOR
HONEYWELL M7284C1000

1A — L1 — L2 — 2

0:1/4

4080 — 4081 — F — –

4100 — +

SHD

FROM LINE 253 — 2490 — RED — BLUE — 2530 — FROM LINE 253

POSITION SWITCH CLOSED
WHEN VALVE IS
FULLY CLOSED

4100 — + — 19 — 4–20 mA CONTROL OUTPUT — 26 — +

4210 — – — 21 — 27 — –

INLET
TEMPERATURE SENSOR
TYPE K THERMOCOUPLE

1A — L1 — L2 — 2

1A — 4 — 5 — 4250

SYSTEM READY TEMP
PLC I:0/0

BLUE — PLC 0/5 — 4271 — G — +

10 — 12

TO CUSTOMER
CONTROLS

4291 — –

11 — 13

TEMPERATURE
SWITCH

2250 — 8 — 9 — 2251

4–20 mA
OUTLET
PROCESS VARIABLE
4mA = 0 F
20mA = 2000 F

INLET TEMP CONTROL
HONEYWELL UDC 2500
PN: DC2500–CE–1A00–200–00000–00–0

FROM LINE
225

1A
UNSWITCHED POWER

2
NEUTRAL

FROM LINE 225

2251 — 2252

TEMPERATURE
HIGH LIMIT
SWITCH

2251 — 6 — 7 — 2252

FROM LINE 762

7620 — 10 — 9 — 7621

FROM LINE 762

1 — 4430 — 2CR640 — RESET

2 — 4440

+ — 4

CATALYST OUTLET
TEMPERATURE SENSOR
TYPE K THERMOCOUPLE

– — 3

WATLOW LV LIMIT CONTROL
PN: LVC6HW10002000A

1A — VLS HIGH HIGH LEVEL — 4560

VLS HIGH HIGH LEVEL
PLC I:4/1

1A — VLS HIGH LEVEL — 4580

VLS HIGH LEVEL
PLC I:4/2

1A — VLS LOW LEVEL — 4600

VLS LOW LEVEL
PLC I:4/3

REV	BY	DATE	CHANGE
0	EAM	1/5/10	Submittal

INTELLISHARE ENVIRONMENTAL
CLEAN AIR SOLUTIONS

PROJECT ID

TITLE
ELECTRICAL SCHEMATIC
TO 500

DRAWING NO.
N–09–0958 –404

SCALE
NONE

DRAWN EAM — DATE 1/5/10

CHECKED — DATE

APPROVED — DATE

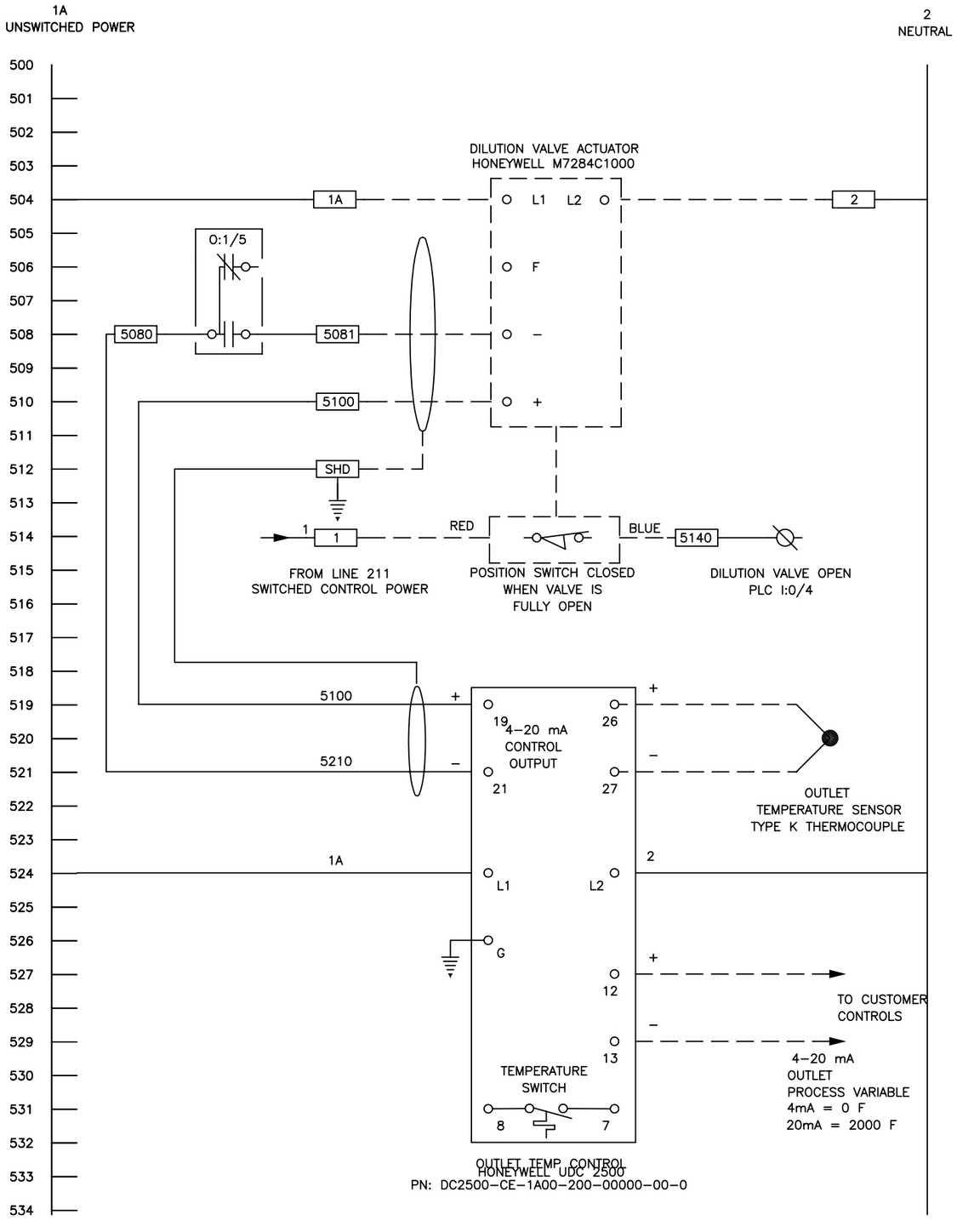
CUSTOMER
DP Stephens

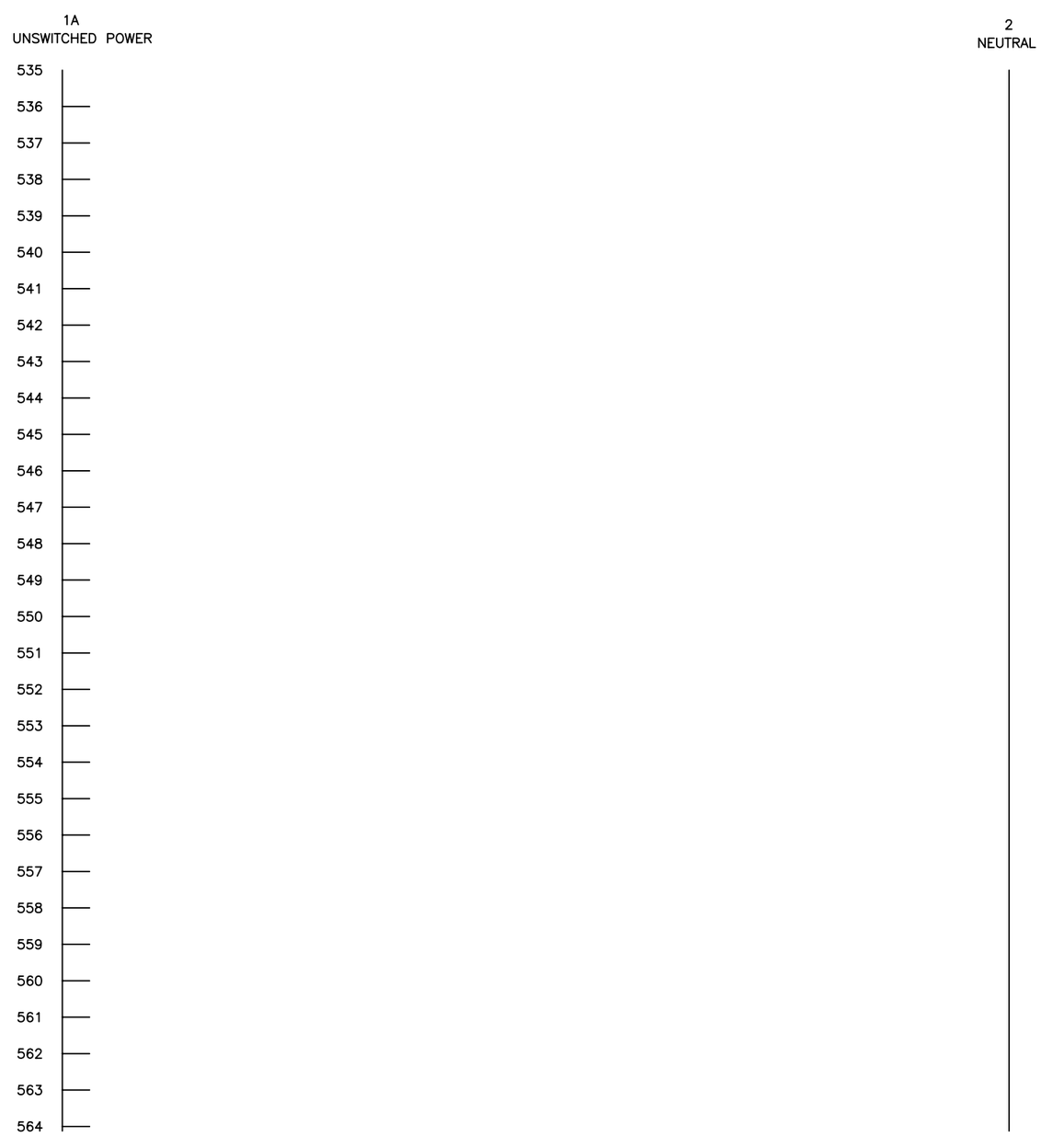
LAST DRAWN BY EAM — DATE 1/5/10

KF NUMBER 10104

PAGE 1 OF 1

LAST PLOTTED BY EAM DATE 1/5/10





REV	BY	DATE	CHANGE
0	EAM	1/5/10	Submittal

INTELLISHARE ENVIRONMENTAL
CLEAN AIR SOLUTIONS

PROJECT ID

TITLE
ELECTRICAL SCHEMATIC
TO 500

DRAWING NO.
N–09–0958 –405

SCALE
NONE

DRAWN EAM DATE 1/5/10

CHECKED DATE

APPROVED DATE

CUSTOMER
DP Stephens

LAST DRAWN BY EAM DATE 1/5/10

KF NUMBER 10104

PAGE 1 OF 1

LAST PLOTTED BY EAM DATE 1/5/10

1A
UNSWITCHED POWER

PLC – BASE UNIT
ALLEN–BRADLEY
1763–L16AWA
MICROLOGIX 1100

PLC INPUTS REFERENCE

2
NEUTRAL

600	SYSTEM READY TEMP – SEE LINE 425	4250	I:0/0	
601	E–STOP – SEE LINE 213	1	I:0/1	AC COM
602	LOW FUEL PRESSURE SWITCH – SEE LINE 220	2200	I:0/2	
603	HIGH FUEL PRESSURE SWITCH – SEE LINE 220	2201	I:0/3	
604	DILUTION VALVE OPEN SWITCH – SEE LINE 514	5140	I:0/4	
605	L.E.L. SWITCH – SEE LINE 225	2250	I:0/5	AC COM
606	HIGH INLET TEMP – SEE LINE 225	2251	I:0/6	
607	HIGH OUTLET TEMP – SEE LINE 225	2252	I:0/7	
608	SVE BLOWER RUNNING – SEE LINE 237	2370	I:0/8	
609	SYSTEM AIR PROVEN – SEE LINE 237	2371	I:0/9	
610	FLAME STRENGTH COMMON – SEE LINE 308	3080	IA COM	
611	FLAME STRENGTH SIGNAL – SEE LINE 310	3100	IV (+)	
612			IV (+)	
613				
614				
615				
616	COMBUSTION FAN RUNNING – SEE LINE 243	2430	I:1/0	
617	COMBUSTION AIR PROVING SWITCH – SEE LINE 243	2431	I:1/1	AC COM
618	HIGH DF PRESSURE INTERLOCK – SEE LINE 249	2490	I:1/2	
619	BURNER MOD VALVE CLOSED – SEE LINE 253	2530	I:1/3	
620	DUNGS VALVES CLOSED – SEE LINE 253	2531	I:1/4	
621	FLAME FAILURE – SEE LINE 323	3230	I:1/5	AC COM
622	BURNER ON – SEE LINE 363	3630	I:1/6	
623	SVE/AS SYSTEM RUNNING – SEE LINE 712	7120	I:1/7	
624				
625				
626	MSP127 TRANSFER PUMP AUX	6260	I:4/0	
627	VLS HIGH HIGH LEVEL – SEE LINE 456	4560	I:4/1	AC COM
628	VLS HIGH LEVEL – SEE LINE 458	4580	I:4/2	
629	VLS LOW LEVEL – SEE LINE 460	4600	I:4/3	
630			I:4/4	
631			I:4/5	AC COM
632			I:4/6	
633			I:4/7	
634				

1A
UNSWITCHED POWER

PLC – BASE UNIT
ALLEN–BRADLEY
1763–L16AWA
MICROLOGIX 1100

PLC OUTPUTS REFERENCE

2
NEUTRAL

635					
636	FROM LINE 211 1	VAC/VDC	SVE BLOWER 0:0/0	VAC/VDC 6360	MS636 MSP105 6421 105, 237
637					
638	FROM LINE 211 1	VAC/VDC	TRANSFER PUMP 0:0/1	VAC/VDC 6380	MS638 MSP127 6421 127, 237
639					
640		VAC/VDC	SYSTEM RESET 0:0/2	VAC/VDC 6400	CR640 443
641					
642	FROM LINE 211 1	VAC/VDC	COMBUSTION FAN ENABLE 0/3	VAC/VDC 6420	MS642 MSP116 6421 116, 243
643					
644	FROM LINE 253 2531	VAC/VDC	BURNER ENABLE 0:0/4	VAC/VDC	TO LINE 253 2532
645					
646	FROM LINE 427 4271	VAC/VDC	SP RAMP 0:0/5	VAC/VDC	TO LINE 427 4291
647					
648					
649	FROM LINE 719 7190	L1–0	READY 0:3/0	OUT0 N.O.	TO LINE 719 7191
				OUT0 N.C.	TO LINE 719 7192
650					
651	FROM LINE 726 7260	L1–1	ALARM 0:3/1	OUT1 N.O.	TO LINE 726 7261
				OUT1 N.C.	TO LINE 726 7262
652					
653	FROM LINE 732 7320	L1–2	SVE ENBL 0:3/2	OUT2 N.O.	TO LINE 732 7321
				OUT2 N.C.	
654		L1–3	SPARE 0:3/3	OUT3 N.O.	
				OUT3 N.C.	
655					
656					
657	FROM LINE 408 4060	L1–4 ENABLE BURNER MOD	0:3/4	OUT4 N.O.	TO LINE 408 4080
				OUT4 N.C.	
658					
659	FROM LINE 508 5080	L1–5 ENABLE DILUTION	0:3/5	OUT5 N.O.	TO LINE 508 5080
				OUT5 N.C.	
660					
661					
662					
663					
664					

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0	EAM	1/5/10	Submittal

INTELLISHARE ENVIRONMENTAL
CLEAN AIR SOLUTIONS

PROJECT ID

TITLE
ELECTRICAL SCHEMATIC
TO 500

DRAWING NO.
N–09–0958 –406

SCALE
NONE

DRAWN EAM DATE 1/5/10
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CUSTOMER
DP Stephens

KF NUMBER 10104

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LAST PLOTTED BY EAM DATE 1/5/10

1A
UNSWITCHED POWER

2
NEUTRAL

700
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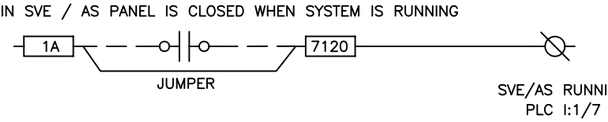
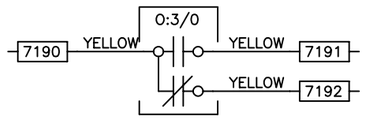
SVE / AS SYSTEM RUNNING CONTACT
DRY CONTACT IN SVE / AS PANEL IS CLOSED WHEN SYSTEM IS RUNNING



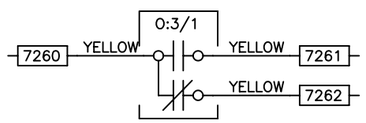
SVE/AS RUNNING
PLC I:1/7

SYSTEM READY CONTACTS FOR REMOTE INDICATION/USE
RELAY ENERGIZES WHEN SYSTEM IS READY TO RECEIVE PROCESS STREAM



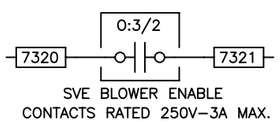
CONTACTS RATED 250V–3A MAX.

SYSTEM ALARM CONTACTS FOR REMOTE INDICATION/USE
RELAY ENERGIZES WHEN SYSTEM IS IN ALARM.

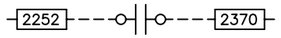


CONTACTS RATED 250V–3A MAX.

CUSTOMER BLOWER ENABLE/RUNNING CONTACTS
RELAY ENERGIZES WHEN THE CUSTOMER BLOWER SHOULD BE RUNNING.



SVE BLOWER ENABLE
CONTACTS RATED 250V–3A MAX.



CUSTOMER BLOWER AUX CONTACT

1A
UNSWITCHED POWER

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NEUTRAL

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764

ALLEN–BRADLEY
1763–L16AWA
MICROLOGIX 1100
PLC

IP – 192.168.1.100

1A
120/240 VAC
2
VAC NEUT
AC COMM
GND

COMMUNICATION PORT
RS232 PORT

ALLEN–BRADLEY PANELVIEW 300 MICRO
PN: 2711–M3A18L1

24+
24–

1A
IDEC 24VDC POWER SUPPLY
PN: PS5R–SD24

1A
GFCI
DUPLEX RECEPTACLE
7620
7621

TO LINE 441
TO LINE 441

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INTELLISHARE ENVIRONMENTAL
CLEAN AIR SOLUTIONS

PROJECT ID

TITLE
ELECTRICAL SCHEMATIC
TO 500

DRAWING NO.
N–09–0958 –407

SCALE
NONE

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CUSTOMER
DP Stephens

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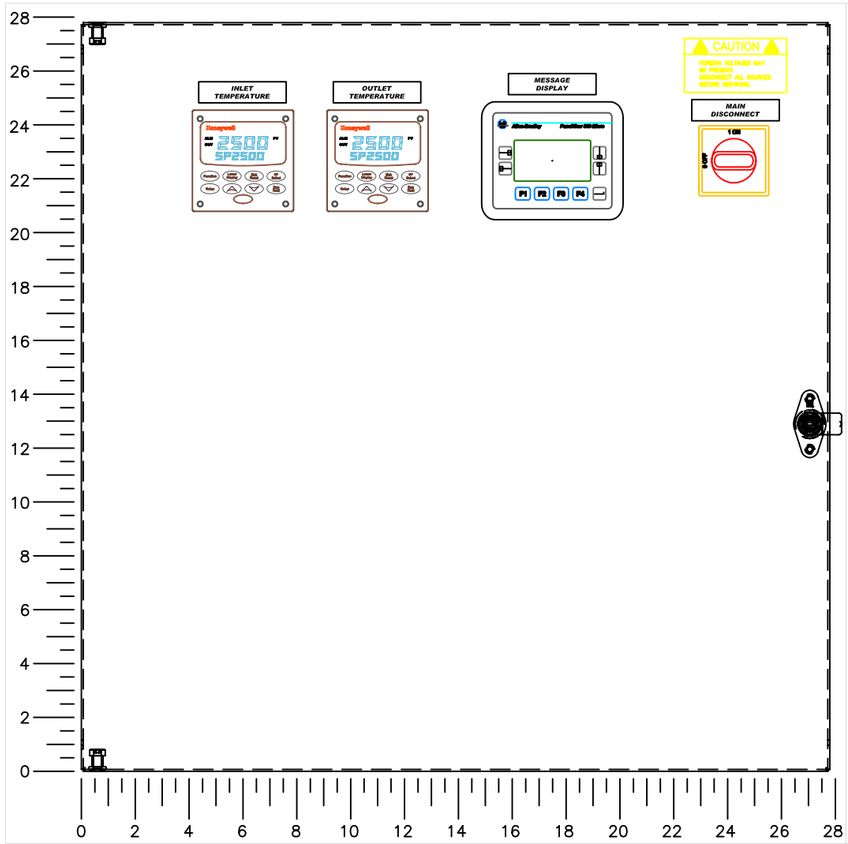
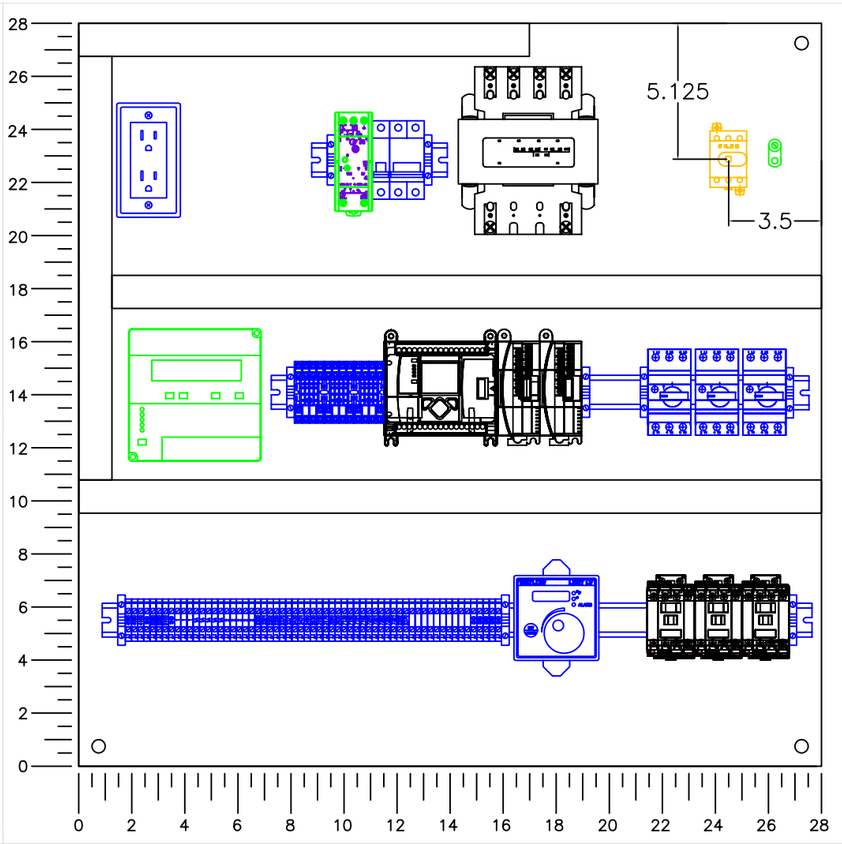
KF NUMBER 10104
PAGE 1 OF 1

LAST PLOTTED BY EAM DATE 1/5/10





ITEM	QTY.	DESCRIPTION	PART NUMBER	MFG.
1	1	ENCLOSURE – 30" x 30" x 12"	C-SD303012	HOFFMAN
2	1	SUBPANEL – 30" x 30"	C-P3030	HOFFMAN
3	1	SWINGOUT KIT – 30" x 30"	C-SP3030	HOFFMAN
4	1	CONTROL TRANSFORMER 460/230-115, 500VA	E500	HEVI-DUTY
5	1	CIRCUIT BREAKER 5A, 2P	WMLT2C05	EATON
6				
7	1	CIRCUIT BREAKER 7A, 1P	WMZT1C07	EATON
8	1	DUPLEX RECEPTICLE + COVER GFCI	7599-I	LEVITON
	1	HANDY BOX	58361-1/2	STEEL CITY
9	1	DISTRIBUTION BLOCK	16220-3	BUSSMAN
10	3	CONTROL RELAY – 4 POLE	RU4S-CA110	IDEC
	3	CONTROL RELAY BASE – 4 POLE	SY4S-05	IDEC
11	4	CUSTOM DEVICE TAG	TAG-CUS	CUSTOM ENGRAVING
12	1	CUSTOM DEVICE TAG – WARNING LABEL	TAG-CUS	CUSTOM ENGRAVING
13	1	HIGH TEMPERATURE SWITCH – LV	LVC6KW10002000A	WATLOW
14	1	TEMPERATURE CONTROLLER – DC2500-CE-1A00-200-00000-00-0		HONEYWELL
15	1	TEMPERATURE CONTROLLER – DC2500-CE-1A00-200-00000-00-0		HONEYWELL
16	36	TERMINAL BLOCK	1492-J3	A-B
	2	TERMINAL END BARRIER	1492-EBJ3	A-B
	1	TERMINAL BLOCK JUMPER	1492-CJLJ5-50	A-B
	10	TERMINAL BLOCK BLUE	1492-J3B	A-B
	9	TERMINAL BLOCK – GROUNDING	1492-JG3	A-B
17	9	DIN RAIL END CLAMP	1492-EAJ35	A-B
18	1	35MM DIN RAIL – SHALLOW	173220.05	ENTERLEC
19	1	35MM DIN RAIL – DEEP	101598.26	ENTERLEC
20	1	GROUND LUG	L70	CONNECTOR MFG
21	8	WIREWAY	F1X3WH6	PANDUIT
	8	WIREWAY COVER	C1WH6	PANDUIT
22				
23	1	PLC BASE UNIT	1763-L16AWA	A-B
	1	PLC INPUT MODULE	1762-IA8	A-B
	1	PLC OUTPUT MODULE	1762-OX6I	A-B
24	1	PB E-STOP OPERATOR (E-STOP)	800FM-MP44	A-B
	1	PB BACKER	800F-ALP	A-B
	1	PB E-STOP LEGEND	800F-15YE112	A-B
	1	PB NC CONTACT BLOCK	800F-X01	A-B
25				
26	1	NON-FUSED DISCONNECT	0T32E3	ABB
	1	NON-FUSED DISCONNECT SHAFT	0XS5X330	ABB
	1	NON-FUSED DISCONNECT HANDLE	0HY2AJ	ABB
27	1	CONTACTOR	100-C12D10	A-B
28	1	MOTOR CIRCUIT PROTECTOR	140M-C2E-C10	A-B
	1	MOTOR CIRCUIT PROTECTOR AUX CONTACT	140M-C-AFA10	A-B
29				
30				
31				
32	1	PANELVIEW 300 MESSAGE DISPLAY	2711-M3A18L1	A-B
	1	PANELVIEW CABLE	1761-CBL-HM02	A-B
33				
34				
35	1	FLAME SAFEGUARD	RM7895B-1013	HONEYWELL
	1	FLAME SAFEGUARD MOUNTING BASE	Q7800A-1005	HONEYWELL
	1	FLAME STRENGTH AMPLIFIER	R7847A-1033	HONEYWELL
	1	PRE-PURGE TIMER 30 SEC.	ST7800A-1039	HONEYWELL
	1	REMOTE RESET MODULE	S7820A-1007	HONEYWELL
36	1	POWER SUPPLY	PS5R-3D24	IDEC
37				

A

B

C

D

E MAIN DISCONNECT (11)

F MESSAGE DISPLAY (11)

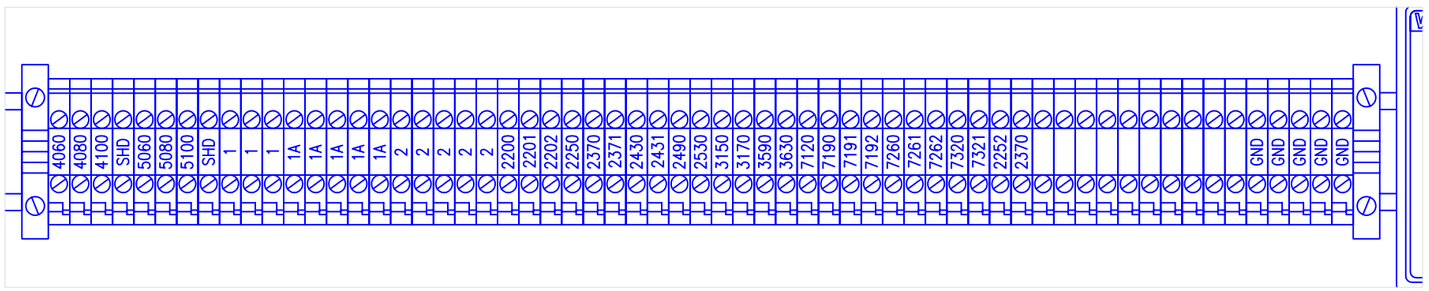
G INLET TEMPERATURE (11)

H OUTLET TEMPERATURE (11)

CAUTION (12)

FOREIGN VOLTAGES MAY BE PRESENT. DISCONNECT ALL SOURCES BEFORE SERVICING.

ENLARGED VIEW OF TERMINAL BLOCKS



REV	BY	DATE	CHANGE
0	EAM	1/5/10	Submittal

INTELLISHARE ENVIRONMENTAL
CLEAN AIR SOLUTIONS

PROJECT ID

TITLE: ELECTRICAL SCHEMATIC TO 500

DRAWING NO.: N-09-0958 -450

SCALE: NONE

DRAWN: EAM DATE: 1/5/10

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APPROVED: DATE:

CUSTOMER: DP Stephens

LAST DRAWN BY: EAM DATE: 1/5/10

KF NUMBER: 10104

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Wiring Instructions/Information

Field Connection	Terminal Strip	Function Text
Y	1	Low Fuel Pressure SW – Common
Y	2200	Low Fuel Pressure SW – Return
Y	2200	High Fuel Pressure SW – Common
Y	2201	High Fuel Pressure SW – Return
O	2201	L.E.L. SW – Common (Optional)
O	2250	L.E.L. SW – Return (Optional)
Y	2370	System Air SW – Common
Y	2371	System Air SW – Return
O	2430	Combustion Air Pressure SW – Common
O	2431	Combustion Air Pressure SW – Return
Y	2431	High DF Pressure SW – Common
Y	2490	High DF Pressure SW – Return
Y	3150	Ignition Transformer – Black Wire
Y	2	Ignition Transformer – White Wire
Y	3170	Pilot Solenoid Valves – Red Wire
Y	2	Pilot Solenoid Valves – Red Wire
Y	2	Blocking & Main Gas Valve Actuator Terminal #1
Y	3210	Blocking & Main Gas Valve Actuator Terminal #2
Y	3210	Blocking & Main Gas Valve Actuator Terminal #3
Y	1	Gas Valve SW – Common – Terminal #3
Y	3590	Gas Valve SW – Return – Terminal #1
Y	3630	Gas Valve SW – Return – Terminal #2
Y	2490	Burner Valve Actuator SW – Common
Y	2530	Burner Valve Actuator SW – Return
Y	1	Dilution Valve Actuator SW – Common
Y	5140	Dilution Valve Actuator SW – Return
Y	1A	Burner Valve Actuator Main Power – L1
Y	2	Burner Valve Actuator Main Power – L2
Y	1A	Dilution Valve Actuator Main Power – L1
Y	2	Dilution Valve Actuator Main Power – L2

Terminal Block TB1 (Control Voltage)

Terminal block "TB1" represents all Control Voltage terminal connections. The "Field Conn." column is marked with an "Y" to identify required field connections, and an "O" for optional connections.

All wiring shall be RED 14 guage type THHN and must be isolated from low voltage wiring.

Warning: Follow appropriate guidlines when wiring to classified environment.

Field Connection	Terminal Strip	Function Text
Y	4081	Burner Valve Actuator – Analog Command (–)
Y	4100	Burner Valve Actuator – Analog Command (+)
Y	5081	Dilution Valve Actuator – Analog Command (–)
Y	5100	Dilution Valve Actuator – Analog Command (+)

Terminal Block TB2 (Low Voltage)

Terminal block "TB2" represents all Low Voltage terminal connections. The "Field Conn." column is marked with an "Y" to identify required field connections, and an "O" for optional connections.

All wiring shall be 18 AWG 3 conductor shielded belden cable or equivilent and must be isolated from high voltage wiring.

Warning: Follow appropriate guidlines when wiring to classified environment.

INCOMING POWER – 460V, 3 Phase

Incoming power shall be wired to the Fuse Block provided, see schematic line #101.
Wire must be sized to meet NEC & Local code requirements.

MOTOR CONNECTIONS

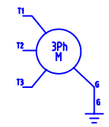
All field wiring for motors shall be black in color and sized to meet local and NEC requirements.

Connections are to be made directly from motor to overload block as shown on page 401 of the schematic.

All motor ground connections are to be connected to ground bar on panel.

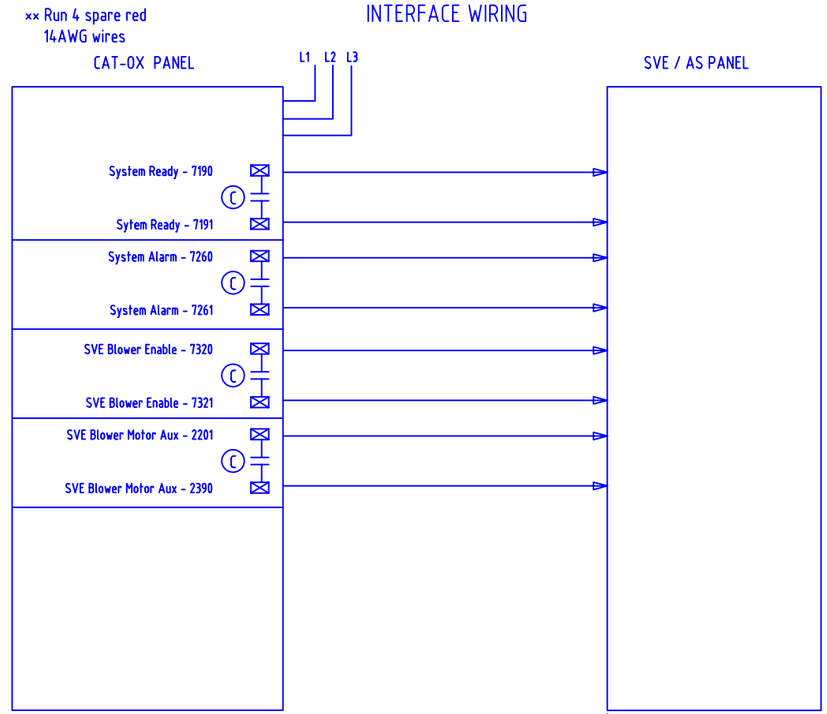
Always isolate from any low voltage wiring.

The motors to be wired are shown below:



MTR	VOLTS	AMPS	WIRE
1M	460V	18	12AWG
2M	460V	3.6	14AWG
3M	460V	1.4	14AWG

INTERFACE WIRING



REV	BY	DATE	CHANGE
0	EAM	1/5/10	Submittal

INTELLISHARE ENVIRONMENTAL
CLEAN AIR SOLUTIONS

PROJECT ID

TITLE: ELECTRICAL SCHEMATIC
TO 500

DRAWING NO.: N–09–0958 –460

SCALE: NONE

DRAWN: EAM DATE: 1/5/10

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CUSTOMER: DP Stephens

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KF NUMBER: 10104

PAGE: 1 OF: 1

LAST PLOTTED BY: EAM DATE: 1/5/10

Appendix D

Technical Specifications

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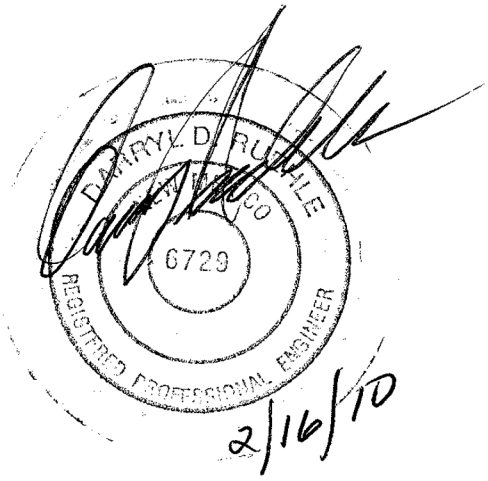


SECTION 22 05 03.01

HIGH DENSITY POLYETHYLENE PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. HDPE pipe.
2. HDPE fittings.
3. HDPE burial.
4. HDPE joining.
5. HDPE testing.

B. Related Sections:
1. Section 31 23 17 - Trenching and Backfill
2. Section 31 23 24 - Flowable Fill

1.2 REFERENCES

A. ASTM International:
1. ASTM D1248 - Standard Specification for Polyethylene Molding and Extrusion Materials.
2. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameters.
3. ASTM D2122 - Determining Dimensions of Thermoplastic Pipe and Fittings.
4. ASTM D2241 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
5. ASTM D2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.
6. ASTM D2513 - Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
7. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe.
8. ASTM D2657 - Standard Practice for Heat-Joining Polyolefin Pipe and Fittings.
9. ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
10. ASTM D2774 - Underground Installation of Thermoplastic Pressure Piping.
11. ASTM D2837 - Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pressure Piping.
12. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
13. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fitting Materials.
14. ASTM F412 - Standard Terminology Relating to Plastic Piping System.

15. ASTM F1248 - Standard Test Method for Determination of Environmental Stress Crack Resistance (ESCR) of Polyethylene Pipe.

B. American Water Works Association:
1. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, ½ in. through 3 in., for Water Service.

1.3 SUBMITTALS

A. Product Data: Submit data on pipe sizes, materials and fittings. Submit manufacturers catalog information.

1.4 QUALITY ASSURANCE

A. Manufacturer Quality Assurance:
1. Manufacturer shall maintain a continuous quality control program.
2. Material certification shall be included verifying that the materials have been tested for conformance with ASTM D3350 and that the pipe material has exceeded 5,000 hours without failure when tested under F1248.

B. HDPE pipe and fittings shall be provided from one approved manufacturer.

C. Maintain one copy of each document on site.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum five years documented experience.

B. Installer: Company specializing in performing work of this section with minimum five years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. All necessary precautions shall be taken to prevent damage or contamination to pipe and other materials during shipment and delivery.

B. All materials shall be securely fastened to truck or rail car to prevent movement or damage during shipment.

C. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

E. All pipe materials shall be handled in such a manner as to prevent damage. HDPE pipe shall not be dropped, rolled or pushed off from any height during delivery, storage or installation.

F. All pipe materials shall be stored off the ground in a dry location.

G. All pipe materials shall be stored in such a manner as to prevent sagging or bending.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 COORDINATION

A. Coordinate installation of buried piping with trenching.

PART 2 PRODUCTS

2.1 POLYETHYLENE PRODUCTS

A. Manufacturers:
1. ISCO Industries.
2. Polypipe, Inc.
3. Performance Pipe, Inc.
4. Substitutions: Permitted with the Engineer's approval.

B. Polyethylene Pipe: Pipe shall be provided in diameters, pressure classes, and dimension ratios (DR) as shown on the plans and in accordance with ASTM D3035. Also:
1. HDPE pipe shall be manufactured from extra high molecular weight polyethylene pipe materials meeting the requirements of cell classification PE345464C Standard PE Code Designation PE3408 as defined by ASTM D3350.
2. Fittings: AWWA C901, molded.
3. Joints: Butt fusion by a qualified technician, trained by an approved manufacturer's representative, and in accordance with the manufacturer's recommended procedures.

C. Typical Material Physical Properties: All pipe and fitting materials shall meet these typical physical properties:

D. HDPE Fittings:
1. The fittings shall be manufactured from the same cell class resin and fully pressure rated to the same pressure rating as the designed piping system.
2. Shall have a controlled outside diameter and produced to the SDR/DR rating for the pressure specified by the Engineer.
3. Shall be specifically manufactured to the standardized dimensions noted on the Drawings.

4. Where applicable, fittings shall meet the requirement of AWWA C901 or AWWA C906.
5. Butt fusion fittings shall be manufactured from the same material as the extruded pipe.
6. Shall be rated for the pressure service at least equal to that of the system pipe.
7. Shall have outlets manufactured to the same DR as that of system pipe.
8. Molded fittings shall be manufactured in accordance with ASTM D3261.
9. Socket fittings shall be manufactured in accordance with ASTM D2683.

2.2 UNDERGROUND PIPE MARKERS

A. Underground pipe marker shall be metallic detectable brightly colored plastic tape.

2.3 BEDDING AND COVER MATERIALS

A. Bedding, cover, and backfill shall be as specified in Sections 31 23 17 and 31 23 24 and as indicated on the Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Contractor shall inspect all piping to assure that the piping is free from defects in material and workmanship.

B. Compatibility of all pipe and fittings shall be verified.

C. Pipe, fittings and accessories that are cracked, damaged, not identified or in poor condition shall be rejected.

D. The Engineer shall have free access to all joints and test joints for determining the suitability of the joining process.

E. Where construction restrictions limit inspection of joints, the Engineer may have the person joining the pipe and or fittings perform a test joint in the presence of the Engineer.

F. The Engineer shall determine the method of testing either by visual examination or bent strap testing.

G. Verify excavations are to required grade, dry, and not over-excavated.

H. Verify trenches are ready to receive piping.

3.2 PREPARATION

A. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection size, location, and inverts are as indicated on Drawings.

B. Joining
1. The pipe and fittings shall be heat fused creating a homogeneous joint.
2. Joining shall be in accordance with the manufacturer's heat fusion recommendations.
3. Joints shall not be of the solvent welded type.
4. Each person making heat fusion joints shall demonstrate proficiency by making joints and test the trial fusion by bent strap testing in accordance with ASTM D2657.
5. Trial joints shall be allowed to cool completely prior to testing and shall not fail at the joint.
6. During construction, at the Engineer’s discretion, a trial fusion shall be made which shall then be allowed to cool and destructively bent strap tested.
7. If the trial fusion should fail, additional trial fusions shall be made and tested until successful fusions are completed.
8. The procedure used to join the trial fusion shall be used for the balance of the day's work, proved the procedure is within the limitations recommended by the manufacturer.
9. The Engineer shall have the authority to disallow any installer's from completing heat fusion of polyethylene pipe if that technician has consecutively failed trial joints.
10. Any person deemed unqualified by the Engineer will require training per Manufacturer’s guidelines at the expense of the Contractor and training shall be documented and submitted to the Engineer.
11. The equipment used to make the heat fusion joint shall be capable of recording the heating and fusion pressures used to join the pipe, recording heater temperature, and storing this information for retrieval.
12. Each field fusion shall be recorded by such equipment and this information shall be made available to the Engineer's representative.

C. Excavate pipe trench in accordance with Section 31 23 17.

D. Install pipe as indicated on Drawings.

E. Install pipe to allow for expansion and contraction without stressing pipe or joints.

F. Install detectable plastic ribbon tape continuously 12 inches above pipeline; coordinate with Section 31 23 17.

3.4 BURIAL

A. All polyethylene pipe must be installed to minimize shear and tensile stresses.

B. Pipe shall be installed in a trench as specified in the construction drawings.

C. Minimum burial depth is specified in the Drawings.

D. The Contractor shall take care to insure haunching material is well placed as to not disturb the pipeline.

E. Final backfill material may consist of the excavated material as specified in the Drawings provided it is free of unsuitable matter, such as clumps of clay, stones, construction debris, and frozen clods of dirt, unless final backfill is under a roadway.

F. Final backfill material shall be compacted as shown on the Drawings. Proctor density shall be determined by ASTM D698 for compaction and density of soils.

G. All polyethylene pipe shall use warning tape for future location.

3.5 FIELD QUALITY CONTROL

A. The Contractor shall test buried pipes in the SVE system by air pressurization testing.

B. The Contractor shall take all precautions to prevent harm, injury, or damage to people and materials.

C. The Contractor shall make every attempt to obtain successful results using the methods described herein. In the event the test results prove inconclusive, as determined by the Engineer, the Contractor may be required to test each pipeline reach hydrostatically, at no additional cost to the Owner.

D. Test Pressure for SVE Conveyance:
1. Unless otherwise specified by the Engineer, test pressure shall be 10 psig for each test segment.
2. If a lower pressure rated device or component cannot be removed or isolated, the test pressure shall be limited to the pressure rating of that device or component.

E. Test Duration for SVE Conveyance:
1. For SVE Conveyance tests the total test time, including initial pressurization, initial expansion, and time at test pressure shall not be less than 2 hours or exceed 8 hours.
2. If the test is not completed due to leakage, equipment failure, etc., depressurize the test section, and then allow 8 hours before bringing the test section up to test pressure again.

F. SVE Pressure Testing.
1. The Contractor shall use compressed air for the test medium.
2. Pressurize the section to the specified gauge pressure.

3. Observe the gauge pressure for one (1) hour.
4. Verify and document that pressure loss over the one (1) hour period does not exceed 1% (percent).
5. Correct pressure loss for temperature in accordance with the manufacturer's recommendations.

G. Test Failure:
1. Perform the following when pipe segment fails pressure test:
   a. Check entire length of pipe and fusions for cracks, pinholes, perforations or other possible leakage points.
   b. Check blocked risers and capped end for leakage.
   c. Verify leaks by applying soapy water solution to joints and fittings.
2. Repair pipe and fused joint leaks by cutting out leaking area and rebonding suitable segments.
3. Retest after repairing leaks.
4. Repeat until passing test is achieved.
5. The Contractor, at his sole expense, shall make necessary repairs or replacements. Repairing and testing shall be repeated until the pipeline installation conforms to the specified requirements and is acceptable to the Engineer.

H. After testing has been concluded, the pipe line shall be restored to a condition satisfactory to the Engineer.

3.6 TEST REPORTING

A. Results of each test shall be reported in writing certified by the Contractor and witnessed by the owner, and include at a minimum the following information:

Test No.:	
Date:	
Station:	
Pipe Material:	
Test Medium (air or water)	
Length (S)	Feet
Diameter (D)	Inches
Test Pressure (P)	PSI
No. of Joints (N)	Each

B. Include following information if failure occurs:
1. Location of failure segment.
2. Nature of leaks.
3. Details of repairs performed.
4. Retest results.

END OF SECTION

SECTION 22 05 03.02

PVC PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes: Pipe and pipe fittings for the following systems:
   1. SVE conveyance system

B. Related Sections:
   1. Section 22 05 23 - Valves.
   2. Section 31 23 17 - Trenching and Backfill.
   3. Section 31 23 24 - Flowable Fill

C. ASTM International:
   1. ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
   2. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings.
   3. ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
   4. ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
   5. ASTM D2564 - Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.

1.2 SUBMITTALS

A. Product Data: Submit data on pipe sizes, materials and fittings. Submit manufacturers catalog information.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.4 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.5 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.6 COORDINATION

A. Coordinate installation of buried piping with trenching.

PART 2 PRODUCTS

2.1 PVC PRODUCTS

A. PVC Pipe: ASTM D1785, Schedule 40, polyvinyl chloride (PVC) material.
   1. Fittings:ASTM D2466, Schedule 40, PVC.
   2. Joints: ASTM D2855, solvent weld with ASTM D2564 solvent cement.

2.2 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon Tape: Bright colored, continuously printed, detectable metallic, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.3 BEDDING AND COVER MATERIALS

A. Bedding, cover, and backfill shall be as specified in Sections 31 23 17 and 31 23 24 and as indicated on the Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify excavations are to required grade, dry, and not over-excavated.

B. Verify trenches are ready to receive piping.

3.2 PREPARATION

A. Remove burrs.

B. Remove dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection sizes, locations, and inverts are as indicated on Drawings.

B. Excavate pipe trench in accordance with Section 31 23 17.

C. Install pipe to elevation as indicated on Drawings.

D. Install pipe on prepared bedding.

E. Install valves at locations indicated on Drawings in accordance with this Section.

F. Install plastic ribbon tape continuously buried 12 inches, above pipe line; coordinate with Section 31 23 17.

G. Pipe Cover and Backfilling:
1. Backfill trench in accordance with Sections 31 23 17 and 31 23 24 and as indicated on the Drawings.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls and floors.

E. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Provide access where valves and fittings are not accessible.

F. Install non-conducting dielectric connections wherever jointing dissimilar metals.

G. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

H. Install piping penetrating roofed areas to maintain integrity of roof assembly.

I. Install valves in accordance with the manufacturer's instructions.

J. Insulate piping as shown in the Drawings.

END OF SECTION

SECTION 22 05 03.03

STEEL PIPING

PART 1 GENERAL

1.1 SUMMARY

1. Section Includes: Pipe and pipe fittings for the hot air injection system.

B. Related Sections:
1. Section 22 05 19.01 - Pressure Gauges
2. Section 22 05 19.02 - Flow Meters
3. Section 22 05 19.03 - Heat Dissipation Sensors
4. Section 31 23 17 - Trenching and Backfill
5. Section 31 23 24 - Flowable Fill
6. Section 44 11 36 - Soil Vapor Extraction System

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B16.3 - Malleable Iron Threaded Fittings.
2. ASME B16.4 - Gray Iron Threaded Fittings.
3. ASME B31.1 - Power Piping.
4. ASME B36.10M - Welded and Seamless Wrought Steel Pipe.
5. ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

B. ASTM International:
1. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
2. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

C. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

1.3 SUBMITTALS

A. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

B. Welders' Certificate: Include welders' certification of compliance with AWS D1.1.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with ASME B31.1 code for installation of piping systems and ASME Section IX for welding materials and procedures.

1.5 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years experience.

B. Installer: Company specializing in performing work of this section with minimum five years experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not install underground piping when bedding is wet or frozen.

1.8 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

1.9 COORDINATION

A. Coordinate installation of buried piping with trenching.

PART 2 PRODUCTS

2.1 HOT AIR INJECTION PIPING

A. Steel Pipe: ASTM A53/A53M, Schedule 40.
   1. Fittings: ASTM A234/A234M, forged steel welding type or threaded couplings.
   2. Joints: Welded or threaded couplings.

2.2 PIPE INSULATION

A. Manufacturers:
   1. ITW Insulation Systems, Model Temperlite® 1200.
   2. Substitutions: Permitted with the Engineer's approval.

2.3 EXPANSION COMPENSATORS

A. Manufacturers:
1. Hyspan Model Series 8504 Expansion Compensator with threaded joints.
2. Substitutions: Permitted with the Engineer's approval.

2.4 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.5 BEDDING AND COVER MATERIALS

A. Pipe Cover and Backfilling:
1. Backfill trench in accordance with Sections 31 23 17 and 31 23 24 and as indicated on the Drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify excavations are to required grade, dry, and not over-excavated.

B. Verify trenches are ready to receive piping.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.3 INSTALLATION - BURIED PIPING SYSTEMS

A. Verify connection size, location, and inverts are as indicated on Drawings.

B. Excavate pipe trench in accordance with Section 31 23 17.

C. Install pipe to elevation as indicated on Drawings.

D. Wrap each length pipe continuously in insulation in the locations indicated on the Drawings.

E. Install pipe on prepared bedding with supports and tie-downs as indicated on the Drawings.

F. Install pipe to allow for expansion and contraction without stressing pipe or joints.

G. Install expansion compensators a minimum of every 18 feet and as indicated on the Drawings.

H. Install expansion compensators at each elbow, tee or appurtenance.

I. Install valves at locations indicated on Drawings in accordance with this Section.

J. Install plastic ribbon tape continuously buried 12 inches, above pipe line; coordinate with Section 31 23 17.

K. Pipe Cover and Backfilling:
   1. Backfill trench in accordance with Section 31 23 17 and 31 23 24 and as indicated on the Drawings.
   2. Do not bond flowable fill concrete insulation to piping or expansion compensators.

3.4 INSTALLATION - ABOVE GROUND PIPING

A. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

B. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.

C. Group piping whenever practical at common elevations.

D. Sleeve pipe passing through partitions, walls, and floors.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Provide access where valves and fittings are not accessible.

G. Install non-conducting dielectric connections wherever jointing dissimilar metals.

H. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.

I. Install piping penetrating roofed areas to maintain integrity of roof assembly.

J. Install valves in accordance with the manufacturer's instructions.

K. Insulate piping as shown in the Drawings.

3.5 FIELD QUALITY CONTROL

A. Test hot air injection piping at 1.5 times operating pressure for 1 hour.

3.6 CLEANING

A. After completion, clean, and treat hot air injection piping.

END OF SECTION

SECTION 22 05 19

GAUGES AND SENSORS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Analog dial-type vacuum gauges.
2. Analog dial-type pressure gauges.
3. Analog differential pressure gauges.
4. Flow sensors.
5. Temperature sensors.

B. Accessories to be furnished and installed at the locations indicated on Drawings.

C. Allowances:
1. Gauges and sensors shall be considered incidental.

1.2 REFERENCES

A. Except as modified or supplemented herein, all gauges shall conform to the requirements of:
1. ANSI/ASME B40.100
2. ANSI Grade 2A or better

1.3 SUBMITTALS

A. Shop Drawings: Required.

B. Product Data: Required.

C. Manufacturer's Installation Instructions: Required.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Required.

B. Operation and Maintenance Data: Required.

1.5 WARRANTY

A. Furnish manufacturer’s warranty.

PART 2 PRODUCTS

2.1 VACUUM GAUGES

A. Manufacturers:
1. Dwyer Series LPG1 Low Pressure Gauge.
2. Substitutions: Permitted with the Engineer's approval.

2.2 PRESSURE GAUGES

A. Manufacturers:
1. Dwyer Series SGT Pressure Gauge.
2. Substitutions: Permitted with the Engineer's approval.

B. Manufacturers:
1. Dwyer Series SGL Pressure Gauge.
2. Substitutions: Permitted with the Engineer's approval.

2.3 DIFFERENTIAL PRESSURE GAUGES

A. Manufacturers:
1. Dwyer Series 2000 Magnahelic.
2. Substitutions: Permitted with the Engineer's approval.

2.4 FLOW SENSOR

A. Manufacturers:
1. Dwyer Series DS In-Line Flow Sensor
2. Substitutions: Permitted with the Engineer's approval.

2.5 TEMPERATURE GAUGES AND SENSORS

A. Manufacturers:
1. U.S. Gauge, Model ADJ Industrial Thermometer
2. Substitutions: Permitted with the Engineer's approval.

B. Manufacturers:
1. DGSI, Model VW Temperature Sensor
2. Substitutions: Permitted with the Engineer's approval.

2.6 GAUGE AND SENSOR CONSTRUCTION:

A. Dwyer Series LPG1
1. Unless otherwise specified, gauges shall be indicating dial type with:
a. Drawn steel housing.
b. Polycarbonate lens.

B. Dwyer Series SGT
1. Unless otherwise specified, gauges shall be indicating dial type with:

a. 304 stainless steel housing.
b. Plexi-glass lens.

C. Dwyer Series SGL
1. Unless otherwise specified, gauges shall be indicating dial type with:
a. 304 stainless steel housing.
b. Shatter-proof safety glass lens.

D. Dwyer Series 2000 Magnahelic
1. Unless otherwise specified, gauges shall be indicating dial type with:
a. Die-cast aluminum housing.

E. Dwyer Series DS In-Line Flow Sensor
1. Unless otherwise specified, gauges shall be insertion-type averaging pitot tube with:
a. 304 stainless steel sensor tube.
b. Parker CPI brass compression fitting
c. Machined stainless steel head.

F. U.S. Gauge, ADJ Industrial Thermometer
1. Unless otherwise specified, gauges shall be indicating dial type with:
a. 304 stainless steel housing.
b. Shatter-proof safety glass lens.

G. DGSI, VW Temperature Sensor
1. Unless otherwise specified, sensors shall be:
a. Brass body.
b. High temperature signal cable.

2.7 OPERATION

A. Dwyer Series LPG (VG-301)
1. The dial shall be 2½ in. diameter with a white background and black markings.
2. The units of measurement shall be indicated on the dial face.
3. Subdivisions of scale shall conform to the requirements of the governing standard.
4. Point travel shall be not less than 200 degrees or more than 270 degrees.
5. Connection shall be 1/4 in. male NPT.
6. Gauges shall be turret-mounted, vacuum-type with an operating range as follows: -100 to 0 inches of water.

B. Dwyer Series SGT (PG-300)
1. The dial shall be 2½ in. diameter with a white background and black markings.
2. The units of measurement shall be indicated on the dial face.
3. Subdivisions of scale shall conform to the requirements of the governing standard.
4. Point travel shall be not less than 200 degrees or more than 270 degrees.
5. Connection shall be 1/4 in. male NPT.

6. Gauges shall be turret-mounted, pressure-type with a pressure operating range as follows: 0 to 30 pounds per square inch and a temperature operating range of Ambient: -4 to 149°F (-20 to 65°C); Process: 518°F (270°C) max.

C. Dwyer Series SGL (PG-301)
1. The dial shall be 4½ in. diameter with a white background and black markings.
2. The units of measurement shall be indicated on the dial face.
3. Subdivisions of scale shall conform to the requirements of the governing standard.
4. Point travel shall be not less than 200 degrees or more than 270 degrees.
5. Connection shall be 1/2 in. male NPT.
6. Gauges shall be turret-mounted, pressure-type with a pressure operating range as follows: 0 to 15 pounds per square inch and a temperature operating range of Ambient: -13 to 149°F (-20 to 65°C); Process: 572°F (270°C) max.

D. Dwyer Series 2000 Magnahelic, (DG-300, DG-302, DG-305, & DG-310)
1. The dial shall be 4 in. diameter with a white background and black markings.
2. The units of measurement shall be indicated on the dial face.
3. Subdivisions of scale shall conform to the requirements of the governing standard.
4. Point travel shall be not less than 200 degrees or more than 270 degrees.
5. Connection shall be 1/4 in. female NPT.
6. Gauges shall be flush-mounted, differential-type.
7. See schedule for operating ranges.

E. Dwyer Series DS In-Line Flow Sensor
1. Sensor shall match the installation pipe nominal diameter.
2. Provide high temperature shut-off valves for installation in hot air injection applications.
3. Connection shall be 1/8 in. female NPT.

F. U.S. Gauge, Model ADJ Industrial Thermometer (TI-300 & TI-301)
1. The dial shall be 3 in. diameter with a white background and black markings.
2. The units of measurement shall be indicated on the dial face.
3. Subdivisions of scale shall conform to the requirements of the governing standard.
4. Connection shall be 1/2 in. female NPT.
5. Temperature gauges shall be turret-mounted, bimetal type.
6. See schedule for operating ranges.

G. DGSI, VW Temperature Sensor (TI-302)
1. The temperature sensor shall be capable of manual or automatic readings using a data recorder or data logger.

2.8 MOUNTING

A. The mounting configuration of each gauge shall be as indicated on the Drawings.

B. Connections

1. As necessary, depending on the thickness class and size of the gauged pipe, a tap or saddle shall be located on the pipe, fitting or appurtenance to be gauged.
2. The attachment shall be made by an appropriately sized NPT nipple in the tap or saddle.
3. Nipples or elbows or combination thereof shall be long enough such that the edge of the gauge case does not contact the pipe; however, in no case shall the distance from the edge of the pipe to the centerline of the gauge exceed 6 inches without prior approval of the Engineer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Gauges shall be installed at the locations indicated on the Drawings.

B. Gauges shall be installed per the manufacturer's guidelines and directions.

C. All gauges shall be installed in the vertical upright position, unless indicated otherwise in the Drawings.

D. Threaded connections shall be assembled using Teflon thread tap or Teflon thread sealer, as specified in the miscellaneous piping section.

3.2 FIELD QUALITY CONTROL

A. Test: Verify all gauge and sensor installations are free from leaks.

3.3 SCHEDULE

Gauge ID	Range	Manufacturer	Model	Count
VG-301	-100 to 0" w.c	Dwyer	LPG	14
PG-300	0 to 30 PSI	Dwyer	SGD	3
PG-301	0 to 15 PSI	Dwyer	SGL	7
DG-300	0 to 100" w.c.	Dwyer	2000	1
DG-302	0 to 2" w.c.	Dwyer	2000	2
DG-305	0 to 5" w.c.	Dwyer	2000	1
DG-310	0 to 10" w.c.	Dwyer	2000	2
FM-201	2" diameter pipe	Dwyer	DS-300	3
FM-401	4" diameter pipe	Dwyer	DS-300	3
TI-300	0 to 200 degrees F	USG	ADJ	5
TI-301	0 to 500 degrees F	USG	ADJ	5
TI-302	-20 to 80 degrees C	DGSI	VW	6

END OF SECTION

SECTION 22 05 23

GENERAL DUTY VALVES

PART 1 GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, equipment, and incidentals required to install all valves necessary for the soil vapor extraction, treatment, and hot air injection systems including but not limited to wells, piping, and equipment.

B. Section Includes:
1. Gate valves.
2. Ball valves.
3. Butterfly valves.
4. Check valves.

1.2 REFERENCES

A. ASTM International:
1. ASTM D1785 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
2. ASTM D4101 - Standard Specification for Polypropylene Injection and Extrusion Materials

B. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 67 - Butterfly Valves.
2. MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.
3. MSS SP 110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

A. Product Data: Submit manufacturers catalog information with valve data and ratings for each service.

B. Manufacturer's Installation Instructions: Submit hanging and support methods, joining procedures.

C. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of valves.

B. Operation and Maintenance Data: Submit installation instructions, spare parts lists, exploded assembly views.

1.5 QUALITY ASSURANCE

A. Maintain one copy of each document on site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Do not install valves underground when bedding is wet or frozen.

1.8 WARRANTY

A. Furnish one year manufacturer warranty for valves excluding packing.

1.9 EXTRA MATERIALS

A. Furnish two packing kits for each size valve.

PART 2 PRODUCTS

2.1 GATE VALVES

A. Manufacturers:
1. King Brothers Industries, Model GVP.
2. Substitutions: Permitted with the Engineer's approval.

B. 2-inch (GV-201): Schedule 40, 150 psi at 73 degrees F water temperature, maximum service temperature: 140 degrees F, ASTM D1785 PVC body and gate, hand-wheel, EPDM seals, regular port, glue socket ends.

2.2 BUTTERFLY VALVES

A. Manufacturers:
1. Asahi/America, Inc, Model Type 57.
2. Substitutions: Permitted with the Engineer's approval.

B. 4-inch (BFV-401): 150 psi at 73 degrees F water temperature, maximum service temperature: 140 degrees F, one piece body, ASTM D1785 PVC, lug type flange facing, disc encapsulated with EPDM, stainless steel shaft, locking lever handle.

2.3 BALL VALVES

A. Ball Valves:
1. Manufacturers:

a. Cameron Valves and Measurement, Model T3.
b. Substitutions: Permitted with the Engineer's approval.

2. 2- to 4-inch (BV-201 & BV-301): Pressure class 150 ASME, reduced port, rated for steam, high temperature, fire safe, and female NPT.
3. 1/4-inch (BV-025): Pressure class 2000 WOG, rated for steam, high temperature, fire safe, and male NPT.

2.4 CHECK VALVES

A. Ball Check Valves:
1. Manufacturers:
a. Spears, True Union 2000 Industrial Ball Check Valve.
b. Substitutions: Permitted with the Engineer's approval.
2. 1-inch (CV-101): 235 psi at 73 degrees F water temperature, maximum service temperature: 140 degrees F, ASTM D1785 PVC, spigot end.

B. Spring Loaded Wafer Check Valves:
1. Manufacturers:
a. Cameron Valves and Measurements, Model 4.0-DPW-CI-36-T
b. Substitutions: Permitted with the Engineer's approval.
2. 2- to 4-inch (CV-201 & CV-301): Pressure class 125 ASME, flange, cast iron body, 316 stainless steel internals and female threaded ends. Rated for a maximum temperature of 450 degrees F.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify piping system is ready for valve installation.

3.2 INSTALLATION

A. Install valves with stems upright or horizontal, not inverted, unless indicated otherwise on the Drawings.

B. Install valves with clearance for installation of insulation and allowing access.

C. Provide access where valves and fittings are not accessible.

3.3 VALVE APPLICATIONS

A. Install valves at locations indicated on the Drawings in accordance with this Section.

B. Install ball, butterfly, or gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

C. Install ball, butterfly, or globe valves for throttling, bypass, or manual flow control services.

D. Install vertical ball check valves on discharge of condensate transfer pumps.

E. Install lug end butterfly valves adjacent to equipment when functioning to isolate equipment.

3.4 SCHEDULES

Valve ID	Valve Type	Material	Size, inches	Number of Valves
GV-201	Gate	PVC	2	10
BFV-401	Butterfly	PVC	4	8
BF-301	Ball Valve	CS	3	4
BF-201	Ball Valve	CS	2	3
BV-025	Ball Valve	CS	0.25	6
CV-101	Check	PVC	1	2
CV-301	Check	CI	3	2
CV-401	Check	CI	4	1

END OF SECTION

SECTION 22 30 10

HIGH DENSITY POLYETHYLENE TANKS

PART 1 GENERAL

1.1 SUMMARY

A. This specification covers upright, single-walled, flat bottom SVE condensate storage tank assemblies. The tanks are designed for aboveground, vertical installation, and are capable of containing fluids at atmospheric pressure. Tank capacity shall be 300 gallons.

1.2 MATERIALS

A. The material used shall be virgin polyethylene resin.

1.3 DIMENSIONS AND TOLERANCES

A. All dimensions will be taken with the tank in the vertical position, unfilled. Tank dimensions will represent the exterior measurements.

1.4 SUBMITTALS

A. Product Data: Submit complete information concerning materials of construction, fabrication, and fitting installation locations.

1.5 SCHEDULING

A. Schedule prior to connecting piping work.

1.6 COORDINATION

A. Coordinate work with location and placement of utilities.

PART 2 PRODUCTS

2.1 TANKS

A. Manufacturers:
   1. Snyder Industries, Inc
   2. Substitutions: Permitted with approval of Engineer.

B. Product Description:
   1. Polyethylene tanks shall be 300 gallon single-walled tanks.

2.2 WORKMANSHIP

A. The finished tank wall shall be free, as practicable, of visual defects such as foreign inclusions, air bubbles, pinholes, pimples, crazing, cracking and delaminating that will impair the serviceability of the vessel.

B. All edges where openings are cut into the tanks shall be trimmed smooth.

2.3 THREADED BULKHEAD FITTINGS

A. Furnish threaded bulkhead fittings as required to connect tank to piping as indicated on the Drawings.

B. The bulkhead fittings shall be constructed of polyvinyl chloride (PVC), polypropylene (PP), or other specified material. Gaskets shall be a minimum of ¼ in. thickness and constructed of EPDM.

PART 3 EXECUTION

3.1 DELIVERY, STORAGE AND HANDLING

A. Inspect tanks for damage.

B. Store products in areas protected from weather, moisture, or possible damage; do not store products directly on ground; handle products to prevent damage to interior or exterior surfaces.

3.2 EXAMINATION

A. Verify layout and orientation of tank accessories and piping connections prior to placement.

3.3 INSTALLATION

A. Install SVE condensate storage tanks as indicated on Drawings and in accordance with manufacturer's instructions.

B. Connect piping to tank.

C. Install tank accessories not factory-mounted to complete installation.

3.4 FIELD QUALITY CONTROL

A. Field Testing:
   1. Hydrostatically test each storage tank by filling with water to the overflow pipe level.
   2. Conduct test minimum of 24 hours.
   3. No leakage is permitted.

4. Adjust, repair, modify, or replace components of system failing to perform as specified and rerun tests.

3.5 Schedules

A. Storage Tank Schedule:

Stored Material	Tank Type & Number	Tank Dimensions (Nominal)	Tank Size (Capacity)
SVE condensate water	T-1	35 in. D x 80 in. H	300 gal
SVE condensate water	T-2	35 in. x 80 in.	300 gal

END OF SECTION

SECTION 26 01 00

GENERAL PROVISIONS

PART 1 GENERAL

1.1 The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

1.2 ELECTRICAL DIVISION INDEX

260100	General Provisions
261100	Raceways
261200	Wires and Cables
261300	Outlet Boxes
261330	Cabinets
261400	Wiring Devices
261600	Panelboards
261700	Motor and Circuit Disconnects
261810	Fuses
264500	Grounding
265000	Lighting Equipment
265010	Lamps
265020	Ballasts and Accessories
265110	Fluorescent Fixtures

1.3 REQUIREMENTS

A. Furnish all labor, materials, service, equipment and appliances required to complete the installation of the complete Electrical System in accordance with the Specifications and Contract Drawings.

1.4 REQUIREMENTS OF REGULATORY AGENCIES AND STANDARDS

A. Regulatory Agencies: Installation, materials, equipment and workmanship shall conform to the applicable provisions of the National Electrical Code (NEC), the National Electrical Safety Code (NESC) and the terms and conditions of the Electrical Utility and other authorities having lawful jurisdiction pertaining to the work required. All modifications required by these codes, rules, regulations and authorities shall be made by the Contractor without additional charge.

B. Underwriters Laboratories (UL) or Factory Mutual (FM): All materials, appliances, equipment or devices shall conform to the applicable standards of Underwriters Laboratories, Inc. or Factory Mutual, Inc. The label of, or listing by, UL or FM is required.

C. Standards: Where referenced in these Specifications or on the Drawings, the publications and standards of the following organizations shall apply: Joint Commission on Accreditation of Healthcare Organizations (JCAHO), American Society of Testing and Materials (ASTM), Insulated Power Cable Engineers Association (IPCEA), National Fire Protection Association

(NFPA), American National Standards Institute (ANSI), and National Electrical Manufacturers Association (NEMA).

D. Conflicting code requirements shall be brought to the attention of the Engineer. Where two or more codes apply, the most stringent of the codes shall govern.

1.5 SUBMITTALS AND SUBSTITUTIONS

A. Material List: Within 30 days of Contract Award or Notice to Proceed and before material is ordered, the Contractor shall submit for approval a list of all proposed material and equipment, indicating manufacturer's name and general description.

B. Shop Drawings: Submit for approval a minimum of six copies of all shop drawings no later than 30 days after the material list has been approved and prior to ordering any material. Show complete outlines, dimensions, electrical services, control diagrams, electrical characteristics of special nature or critical to the installation and pertinent data required for installation. Indicate in the transmittal that submittal has been reviewed and accepted and all Contract deviations identified. In addition to specific references or requests; submit shop drawings for the following applicable items: panelboards, lighting fixtures, transformers, primary cable and gear, alarm systems and all special equipment.

C. Substitutions may be requested in accordance with the specification.

PART 2 PRODUCTS

2.1 EQUIPMENT REQUIREMENTS: The Electrical requirements for equipment specified or indicated on the Drawings are based on information available at the time of design. If equipment furnished for installation has Electrical requirements other than indicated on the Electrical Drawings, the Contractor shall make all adjustments to wire and conduit size, controls, overcurrent protection and installation as required to accommodate the equipment supplied, without additional charge to the Owner. All adjustments to the Drawings reflecting the Electrical System shall be delineated in a submittal to the Engineer immediately upon knowledge of the required adjustments. The complete responsibility and costs for such adjustments shall be assigned to the respective section of these Specifications in which the equipment is furnished.

2.2 MATERIALS

A. All similar materials and equipment shall be the product of the same manufacturer.

B. Where no specific material, apparatus or appliance is mentioned, any first-class product made by a reputable manufacturer may be used, providing it conforms to the Contract requirements and meets the approval of the Engineer.

C. Materials and equipment shall be the standard products of manufacturers regularly engaged in the production of such material and shall be the manufacturer's current and standard design.

2.3 ALTITUDE: Equipment affected by altitude shall perform satisfactorily the function intended at the altitude of the project site. The altitude of this project is 7000 feet mean sea level.

PART 3 EXECUTION

3.1 GENERAL: Fabrication, erection and installation of the complete Electrical System shall be done in a first class workmanlike manner by qualified personnel experienced in such work and shall proceed in an orderly manner so as not to hold up the progress of the project. The Contractor shall check all areas and surface where Electrical equipment or material is to be installed, removed or relocated and report any unsatisfactory conditions before starting work. Commencement of work signifies this Contractor's acceptance of the prevailing conditions.

3.2 TEMPORARY POWER AND LIGHTING: Furnish and install all temporary Electrical facilities required for construction and safety operation. No part of the permanent Electrical Systems or the existing Electrical System may be used for temporary service unless approved by the Engineer.

3.3 UTILITIES

A. GENERAL: The Drawings reflect requirements of the serving utilities based on information derived from representatives of the utilities. During the project design phase, the fact that the Engineer may undertake to show the utility(s) requirements, does not necessarily indicate that the Engineer represents the utilities or their requirements; therefore, within 10 working days after Contract Award and/or Notice to Proceed has been issued, the Contractor shall be responsible for coordinating the requirements of the utilities for the Power System. The Owner shall be responsible for coordinating the requirements for the Telephone and Television Systems.

B. Any deviations from the documents shall be brought to the attention of the Engineer no later than 10 working days after Award of Contract and/or Notice to Proceed. Failure to notify the Engineer within the 10-day time frame signifies the acceptance of documents and utility requirements by the Contractor and all associated costs therein.

3.4 EXCAVATION: Comply with Earthwork section.

3.5 PERFORMANCE TESTS

A. Thoroughly test all fixtures, services and all circuits for proper operating conditions and freedom from grounds and short circuits before acceptance is requested. All equipment appliances and devices shall be operated under load conditions.

B. After the interior-wiring system installation is complete and at such time as the Engineer may direct, conduct operating tests for approval. When requested, test all the wire, cable, devices and equipment after installation to assure that all material continues to possess all the original characteristics as required by the governing codes and standards as listed in these Specifications.

C. After occupancy of the building has taken place and nominal building power loads have been established, make voltage readings at all panelboards. Based on these readings make final adjustments of taps on all transformers in the building as directed by the Engineer. Submit to Engineer correspondence and/or drawing delineating readings.

D. Perform such other tests as required by other sections of these Specifications or as requested by the Engineer to prove acceptability.

E. Furnish all instruments and labor for testing.

3.6 OPERATING INSTRUCTIONS AND MANUALS

A. Instructions: Without additional charge to the Owner, the Contractor shall provide an experienced and competent representative to instruct the Owner or his representative fully in the concept, theory, operations, adjustment and maintenance of all equipment furnished for the Electrical System. Contractor shall provide at least two (2) weeks notice to the Engineer in advance of this period.

B. Manuals: Upon completion of the work, prepare and deliver to the Owner two (2) sets of complete operating and maintenance manuals for the systems and major equipment installed. Include catalog data, shop drawings, wiring diagrams, performance curves and rating data, spare parts lists and manufacturer's operating and maintenance data. Operating and maintenance manuals as required herein shall be submitted to the Engineer for review and distribution to the Owner not less than two (2) weeks prior to the scheduled final acceptance of the Project.

C. Other: The above requirements are in addition to specific instruction and manuals specified for individual systems or equipment.

3.7 DRAWINGS

A. General: The Electrical Drawings show the general arrangement of all conduit, equipment, etc. and shall be followed as closely as actual building construction and the work of other trades will permit. The Architectural and Structural Drawings shall be considered as a part of the work insofar as these Drawings furnish the Contractor with information relating to the design and construction of the building. Architectural Drawings shall take precedence over Electrical Drawings. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings, elbows, pullboxes and accessories as may be required to meet such conditions.

B. Field Measurements: The Contractor shall verify the dimensions governing the Electrical work at the building. No extra compensation shall be claimed or allowed on account of differences between actual dimensions and those indicated on the Drawings.

3.8 LOCATION OF EQUIPMENT AND OUTLETS

A. The approximate locations of cabinets, panelboards, wiring gutters, switches, light outlets, power outlets, etc., are indicated on the Drawings; however, the exact location shall be determined after thoroughly examining the general building plans and by actual measurements during construction to avoid conflicts with any Structural, Architectural, or other trades, with all locations subject to the approval of the Engineer.

B. Verify with the Engineer all locations of conduit, boxes, etc., stubbed in the floor prior to installation.

3.9 IDENTIFICATION AND SIGNS

A. Mark each individual motor controller; disconnect switch, transformer and remote control device to identify each item with its respective service using engraved nameplates.

B. Provide nameplates with engraved lettering not less than 3/8" high where specified or noted. In general, use white core laminated plastic, attached with screws. Embossed plastic adhesive tape is not acceptable. Flush mounted devices may have identification engraved in the device plate.

C. Identify panelboards, transformers and cabinets by engraved nameplates with descriptions indicated on the Drawings together with indication of the location of the feeder overcurrent protection. Install on inside of hinged doors or panelboards and cabinets.

Example: Panel 2P
120/208V, 3-phase, 4-wire
Fed from Panel MDP/cct. #4

D. Provide warning signs on all equipment or devices operating at 300 volts or more, reading "DANGER-480 VOLTS", etc. with white letters on red background of standard code size. Signs shall be decals.

E. All underground utilities indicated on the Drawings shall have a 6" wide plastic marker installed continuously in the trench at 12" below grade. The marker shall have continuous markings embossed in the tape identifying the system installed, i.e., communications, telephone, power, and secured computer.

F. COLOR CODING STANDARD

1. Identify Raceways (Conduits) of Special Systems with Color Banding: Band exposed or accessible raceways of the following systems for identification. Bands shall be pre-tensioned, snap-around plastic sleeves, color adhesive marking tape, or a combination of the two. Make each color band 2" wide, completely encircling conduit, and place adjacent bands of two-color markings in contact side by side. Install bands at changes in direction, at penetrations of walls and floors (each side), at junction boxes and terminations, and at 40-foot maximum intervals. Apply the following colors:

Red	Fire Alarm Systems
Blue & Yellow	Access/Security Systems
Green & Blue	Mechanical & Electrical Supervisory Systems
Green & Yellow	Data Systems
Green	Closed Circuit TV
Orange	Sound/Intercom (including Bells)
Orange & Yellow	Telecommunications
Black	120/208 Volt Power
Blue	277/480 Volt Power
Black & Orange	120/208 Volt Emergency Power
Blue & Orange	277/480 Volt Emergency Power

2. Identify Junction, Pull and Connection Boxes: Code-required caution sign for boxes shall be pressure sensitive, self-adhesive label indicating system voltage in black, preprinted on orange background. Install on outside of box cover. Also label box covers with identity of contained circuits. Use pressure-sensitive plastic

labels at exposed locations and similar labels or plasticized card stock tags at concealed boxes.

3. Use conductors with color factory applied the entire length of the conductor except as follows under which conditions field applied color-coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG:

   a. Apply colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6" from terminal points and in boxes where splices or taps are made. Apply the last two laps of tape with no tension to prevent possible unwinding. Use 1" wide tape in colors as specified. Do not obliterate cable identification markings by taping. Tape locations may be adjusted slightly to prevent such obliteration.

   b. In lieu of pressure-sensitive tape, colored cable ties may be used for color identification. Apply three ties of specified color to each wire at each terminal or splice point starting 3" from the terminal and spaced 3" apart. Apply with special tool or pliers, tighten for snug fit, and cut off excess length.

4. Power Circuit Identification: Securely fasten identifying metal tags or aluminum wraparound marking bands to cables, feeders, and power circuits in pull boxes, junction boxes, and switchboard rooms with 1/4" steel letter and number stamps with legend to correspond with designations on Drawings. If metal tags are provided, attach them with approximately 55-lb. test monofilament line or one-piece self-locking nylon cable ties.

5. Tag or Label Conductors as Follows:

   a. Future Connections: Tag or label conductors indicated to be for future connection or connection under another contract with identification indicating source and circuit numbers. Use tags of similar type and system as under Item 4. Submit legend to both site administrator and Ron Gallegos and as applicable only to authorized APS representative or FC&P project manager along with as-built record drawings.

   b. Multiple Circuits: Where multiple branch circuits or control wiring or telecommunication/signal conductors are present in the same box or enclosure (except for three-circuit, four-wire home runs), label each conductor or cable. Provide legend indicating source, voltage, circuit number, and phase for branch circuit wiring. Phase and circuit of branch circuit wiring may be indicated by means of coded color of conductor insulation. For control and telecommunications/signal wiring, use color coding or wire/cable marking tape at terminations and at intermediate locations where conductors appear in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tapes. Submit legend to both site administrator and Ron Gallegos and as applicable only to authorized APS representative or FC&P project manager along with as-built record drawings.

c. Fiber Optic Cable: All fiber optic cable shall bear factory printed cable identification markings indicating the cable is “fiber optic”.

G. Identify all receptacles and switch devices with the circuit and overcurrent protection device. Identification may be by waterproof, permanent marker on the rear of the device cover plate or as approved by the Engineer and Owner.

3.10 WARRANTY: Deliver originals of all guarantees and warranties on this portion of the work to the Engineer. Warrant all equipment, materials and workmanship for one year in accordance with the terms of the Contract.

3.11 PRODUCT HANDLING: Use all means necessary to protect Electrical materials and equipment before, during and after installation and to protect the installed work of other trades.

3.12 RECORD DRAWINGS: As part of this Contract, the Contractor shall provide a complete marked-up set of Contract Documents indicating all changes to the documents during the project construction phase to the Engineer. Changes to the Electrical System shall be documented on a set of "Record Drawings" on a daily basis.

END OF SECTION

SECTION 26 11 00

RACEWAYS

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. General Provisions: Section 260100.

C. Grounding: Section 264500.

PART 2 PRODUCTS

2.1 CONDUITS

A. Rigid Steel Conduit: Rigid, threaded, thick-wall with zinc-coated on the inside and either zinc-coated or coated with an approved corrosion-resistant coating on the outside.

B. Rigid Aluminum Conduit: Rigid, threaded, thick-wall type, approved for the application.

C. Intermediate Metal Conduit (IMC): Rigid, threaded, lightweight steel, zinc-coated or coated on the outside and either zinc-coated or coated with an approved corrosion-resistant coating on the inside.

D. Rigid Non-Metallic Conduit: Schedule 40, high impact PVC with 7,000 psi tensile strength at 73.4 degrees Fahrenheit, 11,000 psi flexural strength, 8,600 psi compression strength, approved 90 degree conductors. Carlon, Triangle or approved equal.

E. Electrical Metallic Tubing (EMT): Mild steel, zinc-coated on the outside and either zinc-coated or coated with an approved corrosion-resistant coating on the inside.

F. Flexible Conduit: Commercial Greenfield, galvanized steel, with a separate grounding bond wire installed in the conduit in addition to other wires.

G. Liquid-Tight Flexible Conduit: Flexible galvanized steel tubing with extruded liquid-tight PVC outer jacket and a separate grounding conductor installed in the conduit.

H. Conduit Size: Minimum conduit size 1/2" except where specifically approved for equipment connections. Sizes not noted on the Drawings shall be as required by the NEC.

2.2 CONDUIT FITTINGS

A. Rigid Steel Conduit, IMC and EMT Fittings: Iron, steel, or die-cast only.

B. Rigid Aluminum Conduit Fittings: Malleable iron, steel or aluminum alloy. Ferrous fittings zinc-coated or cadmium plated. Aluminum alloy fittings shall conform to the characteristics defined by UL for rigid aluminum metallic conduit and shall not contain more than 0.04 percent copper.

C. Rigid Non-metallic Conduit Fittings: Approved for the purpose and as recommended by the manufacturer.

D. Flexible Conduit Fittings (Commercial Greenfield): Either die-cast, steel, or malleable iron only with insulated throats and shall be of one of the following types:

1. Squeeze or clamp type with bearing surface contoured to wrap around the conduit and clamped by one or more screws.

2. Steel, multiple point type, for threading into internal wall of the conduit convolutions.

3. Wedge and screw type with angular in-edge fitting between the convolutions of the conduit.

E. Liquid-tight Flexible Conduit Fittings: With threaded grounding cone, steel, nylon, or equal plastic compression ring and a gland for tightening. Either steel or malleable iron only with insulated throats and male thread and locknut or male bushing with or without "O" ring seal.

F. Connectors and Couplings: Compression type threadless fittings for rigid steel conduit or IMC not permitted. Set-screw type fittings for rigid aluminum conduit not permitted. EMT couplings and connectors either die-cast, steel, or malleable iron only, "Concrete-tight" or "Raintight", and either the gland and ring compression type or the stainless steel multiple point locking type. Connectors to have insulated throats. EMT fittings using set-screws or indentations as a means of attachment are not permitted.

G. Bushings: Insulated type, designed to prevent abrasion of the wires without impairing the continuity of the conduit grounding system, for rigid steel conduit, IMC, and rigid aluminum conduit.

H. Expansion Fittings: Each conduit that is buried in or rigidly secured to the building construction on opposite sides of a building expansion joint and each run of 100 feet of exposed conduit shall be provided with an expansion fitting. Expansion fittings shall be hot dipped galvanized malleable iron with factory-installed packing and a grounding ring.

I. Sealing Fittings: Threaded, zinc or cadmium coated, cast or malleable iron type for steel conduits and threaded cast aluminum type for aluminum conduits. Fittings used to prevent passage of water vapor shall be of the continuous drain type.

2.3 WIREWAYS: Square D Company square duct lay in type without knockouts with lengths and fittings hinged to provide an unobstructed wireway to "lay-in" conductors, use standard lengths. Field cuts permitted where absolutely necessary. Rust-inhibiting phosphatizing coating on sheet metal parts. Blue-gray baked enamel finish. Hardware plated to prevent cross fittings, transposition section, gussett brackets, nipples, pull boxes, reducer fittings, wall flanges, panels or cabinet flanges, elbows, ceiling and wall support brackets and supporting hardware, etc.

PART 3 EXECUTION

3.1 CONDUIT INSTALLATION

A. Conduit Systems: Rigid steel conduit, IMC, rigid non-metallic conduit or EMT unless otherwise specified.

B. Aluminum Conduit: Aluminum conduit may be used only in dry locations above ground in sizes two inch or larger for Power and Communications Systems.

C. Rigid Non-metallic Conduit: Install in accordance with manufacturer's recommendations. Joints shall be solvent welded. Field bends shall utilize approved bending equipment. Provide rigid steel elbows and rigid steel conduit risers on underground runs or runs in concrete. Provide a suitable bond wire in each run except low voltage communications runs. Underground runs under concrete slabs may be direct buried without concrete encasement if of approved type. Rigid non-metallic conduit may be used for the secondary service conduit between the transformer and main distribution panel outside the perimeter of the building only when encased in concrete. Concrete total encasement shall be a minimum of four inches around outside of conduit. Rigid non-metallic conduit is not permitted to be surface mounted in ducts, plenums or other air handling spaces. All 90 degree bends shall be rigid steel conduit. For encased conduits carrying 600 volts or more, the concrete shall be colored red using a permanent dye. Rigid non-metallic schedule 80 conduit may be used for underground special system, Data, Communication, Fire Alarm, Security, TV and Intercom conduit outside the perimeter of the building with RGS steel elbows and conduit risers.

D. EMT: Not permitted underground or embedded in concrete.

E. Flexible Conduits: Use flexible conduit only for motor or equipment connections and then only to the extent of minimum lengths required for connections. Length shall not exceed 5 feet without approval from the Engineer and Owner. Install flexible conduit connections at all resilient-mounted equipment. Provide liquid-tight flexible conduit in exterior, wet or damp locations and for connections to wet pipe mechanical systems.

F. Conduit in Concrete: Rigid steel conduit or rigid non-metallic conduit may not be embedded in concrete that is in direct contact with the earth. When embedded, the outside diameter shall not exceed one-third the thickness of the concrete slab, wall or beam, shall be located entirely within the center third of the member, and the lateral spacing of conduits shall not be less than three diameter unless otherwise prohibited by Engineer.

G. Steel Conduit in Ground: Rigid steel conduit that is not completely encased in concrete but is in contact with ground or on a vapor barrier shall be wrapped with Scotchwrap 51 half-lapped, or shall have an additional outside factory coating of polyvinyl chloride with a minimum coat thickness of 20 mils. Other PVC or Phenolic-resin epoxy coating material which is equally flexible and chemically resistant may be used providing approval by the Engineer is obtained prior to the installation.

H. Exposed Conduits: Install exposed conduit systems parallel to or at right angles to the lines of the building. Right angle bends in exposed runs shall be made with standard elbows, screw jointed conduit fittings or conduit bent to radii not less than those of standard elbows.

I. Concealed Conduits: Install conduit systems concealed unless otherwise noted. Conduit systems may be exposed in unfinished utility areas, ceiling cavities, and where specifically approved by the Engineer. Install concealed conduit systems in as direct lines as possible.

J. Conduit Openings: Protect all vertical runs of conduits or EMT terminating in the bottoms of boxes or cabinets, etc., from the entrance of foreign material prior to installation of conductors.

K. Sealing Fittings: Install where required by the NEC, where conduits pass from warm to cold locations and where otherwise indicated.

L. Sleeves for Conduit: Install sleeves for conduit where shown or as required. Conduit sleeves not used shall be plugged with recessed type plugs. Sleeve all conduit passing through walls. Sleeves that are used shall be sealed tight with rated fire and smokeproofing compounds.

3.2 CONDUIT SUPPORTS

A. Supports: Provide supports for horizontal steel conduits and EMT not more than eight feet apart with one support near each elbow or bend and one support within one foot of each coupling, including runs above suspended ceilings.

B. Straps: Install one-hole pipe straps on conduits 1-1/2" or smaller. Install individual pipe hangers for conduits larger than 1-1/2". Spring steel fasteners with hanger rods may be used in dry locations in lieu of pipe straps.

C. Trapezes: Install multiple (trapeze) pipe hangers, Uni-Strut or approved equal, where two or more horizontal conduits or EMT run parallel and at the same elevation. Secure each conduit or EMT to the horizontal hanger member by specifically designed and approved fasteners for the system used.

D. Hanger Rods: Install 1/4" diameter or larger steel rods for trapezes, spring steel fasteners, clips and clamps. Wire or perforated strapping shall not be used for the support of any conduit or EMT.

E. Fastening: Fasten pipe straps and hanger rods to concrete by means of inserts or expansion bolts, to brickwork by means of expansion bolts, and to hollow masonry by means of toggle bolts. Wooden plugs and shields shall not be used. Power-driven fasteners may be used to attach pipe straps and hanger rods to concrete where approved by the Engineer. All conduits not embedded in concrete shall be firmly secured by means of pipe clamps, hangers, etc., equal to Caddy Fasteners of ERICO Products, Inc., or approved equal. Wire wrapped around conduits and supporting members will not be accepted. Conduit fastened to the wall above the ceiling is not acceptable.

3.3 IDENTIFICATION: Identify per Section 260100, Paragraph 3.09F.

3.4 CLOSING OF OPENINGS: Wherever slots, sleeves or other openings are provided in floors or walls for the passage of conduits or other forms of raceway, including bus ducts, such openings, if unused, or the spaces left in such openings, shall be closed in a manner approved by the Engineer. All closure material along with installation methods shall retain the fire rating integrity of the surface being penetrated. All openings in walls or floors remaining after removal of existing conduits, raceways, or bus ducts shall be closed in a like, approved manner.

END OF SECTION

SECTION 26 12 00

WIRES AND CABLES

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. General Provisions: Section 260100.

C. Grounding: Section 264500.

1.2 SUBMITTALS

A. Primary Cable: Submit catalog cuts and descriptive literature, including data on conductor type, voltage rating, insulation type and thickness, jacket type and thickness (if any) and evidence of meeting respective IPCEA Standards.

PART 2 PRODUCTS

2.1 WIRES AND CABLES (600 VOLTS)

A. Type:

1. Conform to the applicable UL and IPCEA Standards for the use intended. Copper conductors with 600 volt insulation unless otherwise specified or noted on the Drawings. Stranded conductors for No. 6 and larger and where elsewhere specified or noted on the Drawings.

2. All conductors shall be copper. Aluminum conductors will be permitted only on 600 volt and above systems.

B. Insulations: Type THWN insulation unless otherwise specified or noted on the Drawings. Type THWN minimum or type XHHW filled cross-linked polyethylene 90 degree C. thermosetting insulation for conductors larger than No. 6 and elsewhere as required by NEC. 90 degrees C. minimum insulation within fixture wireways of fluorescent fixtures.

C. Size: No. 12 minimum unless otherwise specified or noted on the Drawings. Not less than NEC requirements for the system to be installed.

D. Color Coding: Phase, neutral and ground conductors color-coded in accordance with NEC. Connect all conductors of the same color to the same phase conductors.

Phase A	Phase	Phase C	Neutral

120/240V/1 Phase	Black	Red	-----	White
208Y/120V/3 Phase	Black	Red	Blue	White

Ground shall be Green for all systems.

E. Conductors No. 12 and 10 shall be solid color compounded for the entire length and each like color shall be connected only to the particular phase throughout the project. Conductor sizes larger than No. 10 may be color-coded at each termination and in each box or enclosure with six inches of half-lapped 3/4" pressure sensitive, plastic tape of respective colors in lieu of solid color compound.

2.2 CONTROL CONDUCTORS: Copper, minimum size No. 14 with 19/35 stranding, color-coded filled cross linked polyethylene 90 degree C. 600 volt insulation and neoprene or equal outer jacket, equal to General Electric SI-58109 or SI-58742. Multi-conductor control cables shall be provided where more than three control conductors are installed in the same conduit between common terminations. Provide two spare conductors minimum in each control cable.

2.3 COMMUNICATION AND ELECTRONIC CABLE: As required or specified in the section of these Specifications specifying the equipment. Splices shall be crimped or soldered or shall use an approved connector.

2.4 VERTICAL CABLE SUPPORTS: Split wedge type supports which clamp each individual conductor and tightens due to weight of the cable shall be used without metallic sheath.

2.5 CONNECTORS AND LUGS

A. For copper conductors No. 6 and smaller: 3M Scotch-Lok or T & B Sta-Kin, or equal compression or indent type connectors with integral or separate insulating caps.

B. For copper conductors larger than No. 6: Solderless, indent, hex screw, or bolt-type pressure connectors, properly taped or insulated.

2.6 TAPE: Plastic tape, 8.5 mils minimum thickness, 1,000,000 megohms minimum insulation resistance, oil resistant vinyl backing, oil resistant acrylic adhesive, incapable of supporting combustion per ASTM D-1000. Equal to 3-M Super 88 Tape.

2.7 FEEDER CIRCUITS: Single conductor feeder cables shall be of the size and type as indicated on the Drawings. Sizes shown are for copper conductors unless otherwise noted on Drawings.

2.8 BRANCH CIRCUITS

A. Branch circuits shall be No. 12 AWG copper minimum and shall be larger AWG size where indicated on Drawings. Where branch circuits exceed 100 ft. in length, the AWG size shall be increased to accommodate voltage drop.

B. Branch circuits to all equipment, fixtures and outlets shall include a white neutral and green wire equipment ground.

2.9 TERMINATIONS: Cold shrink stress relief cones shall be installed at all terminations where shielded cable is used and shall be installed in strict accordance with the recommendations of Electro-Products Division/3M.

PART 3 EXECUTION

3.1 WIRE AND CABLE TESTS (600 VOLTS): Measure the insulating resistance of service entrance conductors, feeder circuit conductors and service ground. Measurements shall be taken between conductors and between conductors and ground. Resistance shall be 1,000,000 ohms or more when tested at 500 volts by megger without branch circuit loads. Tests and procedures shall meet the approval of the Engineer, and shall be in accordance with the applicable IPCEA standards for the wires and cables to be installed. Furnish all instruments, equipment and personnel required for testing, and conduct tests in the presence of the Engineer. Submit written reports of the tests and results when requested by the Engineer.

3.2 SPLICES (480 VOLTS AND UNDER): Permitted only at outlets or accessible enclosures. Conductor lengths shall be continuous from termination to termination without splices unless approved by the Engineer.

3.3 PULL WIRES: In each empty conduit, except underground conduits, install a plastic line having tensile strength of not less than 200 pounds. In each empty underground conduit, install a No. 10 AWG bare, hard-drawn copper pull wire or a plastic line having a tensile strength of not less than 200 pounds.

3.4 RACEWAYS: Install in rigid conduit, EMT, or flexible metallic conduit, unless otherwise specified or noted on the Drawings.

3.5 CABLE BENDS: Radius or bends not less than ten times the outer diameter of the cable.

3.6 CONDUCTOR PULL: Conductors shall not be pulled into conduits until after all plastering or concrete work is completed and all conduits in which moisture collected have been swabbed out.

3.7 FEEDER IDENTIFICATION: Tag feeder circuits in each enclosure with wrap-around circuit designation labels.

3.8 CONNECTORS AND LUGS: Install with manufacturer's recommended tools and with the type and quantity of deformations recommended by manufacturer.

3.9 BUNDLING: Conductors No. 10 and smaller shall be neatly and securely bundled and conductors larger than No. 10 shall be neatly and securely cabled in individual circuits, utilizing marlin twine, two-ply lacing or nylon straps.

END OF SECTION

SECTION 26 13 00

OUTLET BOXES

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. General Provisions: Section 260100.

C. Grounding: Section 264500.

PART 2 PRODUCTS

2.1 OUTLET BOXES

A. Construction: Zinc-coated or cadmium plated sheet steel boxes of a class to satisfy the conditions at each outlet except where unilet or condulet bodies are required. Knockout type with knockouts removed are required. Knockout type with knockouts removed only where necessary to accommodate the conduit entering. Square cornered, straight sided gang boxes, 4" octagon concrete rings and 4" octagon hung ceiling boxes with bars may be folded type; one-piece deep-drawn for all other boxes.

B. Size: To accommodate the required number and sizes of conduits, wires and splices in accordance with NEC requirements, but not smaller than size shown or specified. Standard concrete type boxes not to exceed six inches deep except where necessary to permit entrance of conduits into sides of boxes without interference with reinforcing bars. Special purpose boxes shall be sized for the device or application indicated.

C. Fixture Studs: 3/8" malleable iron fixture stud in outlet boxes for ceiling lighting fixtures and interior bracket lighting fixtures, other than lamp receptacles and drop cords.

D. Exposed: Screw-joint type with gasketed weatherproof covers in locations exposed to the weather.

E. Tile Boxes: Rectangular in shape with square corners and straight sides for receptacles and switches mounted in furniture cabinets or in glazed tile, concrete block, marble, brick, stone or wood walls. Install without plaster rings.

F. Wall-Mounted Switch, Receptacle and Signal Boxes: Unless otherwise noted or specified not less 4" square by 1-1/2" deep for 2 devices and multi-gang boxes for more than 2 devices. Boxes for switches and receptacles on unfinished walls may be screw-joint type with covers to fit the devices.

G. Wall-mounted Telephone Outlet Boxes: 4" square by 2-1/8" deep unless otherwise noted in the Drawings.

H. Light Fixture Boxes: 4" diameter by 1-1/2" deep minimum for ceiling and interior bracket fixtures with concealed conduits. Plaster covers for bracket fixtures to have 3" diameter openings. Screw-joint boxes with canopy seat for ceiling and interior bracket fixtures with exposed conduits.

I. Grounding Terminal: Provide a grounding terminal in each box containing a green equipment ground conductor, or serving motors, lighting fixtures or receptacles. Grounding terminal shall be green colored washer-in-head machine screw or grounding bushing.

2.2 PULLBOXES: Minimum NEC requirements unless larger box is noted. As specified for outlet boxes with blank cover for pullboxes with internal volume not more than 150 cubic inches. As specified for cabinets or pullboxes with internal volume over 150 cubic inches, except covers to have same thickness as box with corrosion-resistant screw or bolt attachment.

2.3 FLOOR BOXES: Heavy duty, cast, adjustable type, suitable for the device or application intended, unless noted. Provide metal carpet flanges in carpeted areas.

PART 3 EXECUTION

3.1 OUTLET BOXES

A. Installation: Unless otherwise specified or shown on the Drawings, outlet boxes shall be flush mounted and the front edges of the boxes or plaster covers shall be flush with the finished wall or ceiling line or if installed in walls and ceiling of incombustible construction, not more than 1/4" back of same. Mount boxes with the long axes of devices vertical, unless otherwise specified. Boxes in plastered walls and ceilings shall be provided with plaster covers. Box extensions and/or covers will not be permitted. Install in a rigid and satisfactory manner with suitable metal bar hanger, box cleats, adjustable box hangers, etc. Use wood screws on wood, expansion shields on masonry and machine screws on steel work. Boxes shall be secured to metal studs with sheet metal screws. Metal stud clips, such as Caddy “MSF”, are not acceptable. All boxes shall have far side box supports installed similar to Caddy #766.

B. Mounting Heights: The mounting height of a wall-mounted outlet box shall be construed to mean the height from the finished floor to the horizontal centerline of the cover plate. On exposed tile, block or brick construction, mount outlet boxes at the nearest bed joint to the mounting height indicated. The height of all outlets shall be at the same height when there is a secondary type wall construction along with the masonry construction. The height in the masonry construction shall be the governing factor. Verify exact height of all boxes with Engineer.

C. Wall mounted switch, receptacle and signal outlets: On columns, pilasters, etc., mount so the centers of the columns are clear for future installation of partitions. Install outlet boxes near doors or windows close to the trim. Install outlet boxes near the doors or the lock sides as shown on Architectural Drawings unless other locations are approved by the Engineer.

3.2 PULLBOXES: Provide additional pullboxes wherever necessary to meet requirements for maximum lengths of conduit runs and maximum numbers of bends as specified under "Conduit

and Fittings".

3.3 FLOOR BOXES: Install level with top covers adjusted flush with finished floor or floor tile.

3.4 FIXTURE CONNECTIONS: Recessed or surface light fixtures in lay-in or accessible ceilings shall be connected with minimum 1/2" flexible metallic conduits, 4 to 6 feet long with grounding provisions.

3.5 IDENTIFICATION: Identify all exposed junction and pullboxes according to the system carried by means of painted-on stencils or labels with legible letters and contrasting colors without abbreviations. In general, use yellow color.

END OF SECTION

SECTION 26 13 30

CABINETS

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. General Provisions: Section 260100.

C. Grounding: Section 264500.

PART 2 PRODUCTS

2.1 GENERAL: Sheet steel except those exposed to wet or rain conditions that shall be raintight unless otherwise noted. Cabinets without through feeder wiring shall be arranged to provide a wiring gutter not less than 4" wide for branch circuit panelboards served by feeders up to 4/0. Panelboards served by feeders in excess of 4/0, up to and including 750 MCM, shall be provided with top, bottom and side gutters 8" wide. Panelboard cabinets in all cases shall meet or exceed the minimum requirements of Article 373-6 of the National Electrical Code. Cabinets shall be of standard make and shall be equal in all respects to those bearing the Underwriters Laboratories label. Cabinets, including boxes shall be made of galvanized steel. All outside surfaces of trim and doors shall be given a factory finish coat of No. 61 ANSI gray paint, or approved manufacturer's standard. Cabinet for telephone and communications systems shall have 5/8" exterior grade, one-face B-grade or equal plywood backboard inside with maximum height and width.

2.2 FEED THROUGH GUTTERS: Where feeders go through panelboard cabinets to serve panelboards above or beyond, the wiring gutters in panelboard cabinets shall be a minimum of 8" on sides, top and bottom.

2.3 FRONTS: One piece sheet steel frame and a hinged door with catch and lock for flush cabinets. Telephone and signal cabinets for surface mounting shall be equipped with a door hinged directly to cabinet. One piece sheet steel with 3/4" flange with all edges shaped to cover edge of box. Fronts may be secured to box by means of flathead screws with captive nuts or clamps.

2.4 DOORS: Doors shall close against a rabbet placed all around the inside edge of the frame with a close fitting joint between door and frame. The doors shall be fitted with substantial flush hinges placed not over 24" apart, nor more than 6" from ends of doors, and fastened permanently to the door and frame with flat-headed rivets or spot welds, or with concealed flush piano hinges. Fastening screws of fronts shall be set not over 24" apart. Doors over 48" in height shall be equipped with a vault hinge and a three point catch.

2.5 DOOR-IN-DOOR: Both surface and flush cabinets shall be door-in-door. The door over the interior of the cabinet shall be provided with hinges and combined lock and latch. The outside door over the cabinet gutters shall have a hinge on one side, and machine screws into threaded holes in

the cabinet on the other three sides. In order to insure the rigidity of the outside door, surface type cabinets shall have a 1/2" deep lip bent over all around, with the corners welded and grounded; or in the case of flush cabinets, a steel angle frame, equivalent in strength to the bent over lip, shall be welded to the inside of the door. The outside door shall be of such size as to allow a minimum of 2-3/4" opening to all four sides of the wiring gutter. All locks shall be keyed alike.

2.6 LOCKS: Furnish each cabinet with a combination catch and flat key lock. The telephone, electrical and signal cabinet locks shall be fitted to separate keying for each system. Furnish two keys for each cabinet.

2.7 GROUND BAR: Each cabinet for a panelboard shall be provided with a copper interior ground bar suitably braced or bolted to the cabinet wall. The equipment ground bar shall be equivalent in current carrying pressure connector terminations for the associated feeders, branch circuits, etc.

PART 3 EXECUTION

3.1 CABINETS: Cables installed in the wiring gutters of cabinets shall be neatly bundled, routed and supported. Minimum bending radii as recommended by the cable manufacturer shall not be reduced. Lighting and power cabinets shall be installed with tops 6'-6" above floor and bottoms not less than 12" above floor. The height above floor of the highest over current device handle shall not exceed 6'-6".

END OF SECTION

SECTION 26 14 00

WIRING DEVICES

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. General Provisions: Section 260100.

C. Grounding: Section 264500.

PART 2 PRODUCTS

2.1 SNAP SWITCHES: Unless otherwise specified each snap switch (flush tumbler-toggle) shall be of the AC general use type for mounting in a single-gang spacing, fully rated 20 amperes, 120-277 volts, conforming to minimum requirements of the latest revision of the Underwriters Laboratories, Inc., UL 20, Fifth Edition, Standard Snap Switches and further requirements herein specified. Specification grade, heavy duty, single pole, three way or four way, of the maintained momentary or lock type as indicated on the Drawings. Ivory color handles unless otherwise indicated on the drawings. Silver or silver alloy contacts, AC 120/277 volt general use snap switches shall be capable of withstanding tests as outlined in NEMA Publication WDI-1956, and shall be as follows unless otherwise noted:

20A120-277V AC	Hubbell	Bryant	P & S
1P	1221-I-IV	4901-I-IV	20-AC-1-I-IV
2P	1222-I-IV	4902-I-IV	20-AC-2-I-IV
3 way	1223-I-IV	4903-I-IV	20-AC-2-I-IV
4 way	1224-I-IV	4904-I-IV	20-AC-3-I-IV

2.2 RECEPTACLE

A. General: Configuration and requirements for all connector or outlet receptacles shall be in accordance with NEMA Publication WDI-1965, Part 3 and Part 10. Single or duplex as shown or noted on Drawings. Ivory color unless otherwise noted on the drawings. Double grip contacts for each prong.

B. Grounding Type: All receptacles shall be grounding type with a green colored hexagonal equipment ground screw of adequate size to accommodate an insulated grounding jumper (based on Table 250-95 of the NEC with minimum size No. 14 AWG). Grounding terminals of all receptacles shall be internally connected to the receptacle mounting yoke.

C. Unless otherwise noted, receptacles shall be as follows:

Type	Hubbell	Bryant	P&S
Spec. Grade Duplex - 20 amp	5362-I	5362-I	5362-I
GFCI, Spec. Grade Duplex - 20 amp	GF-5362-I	GFR53FT-I	2091-FI
Isolated Gnd., Orange, Spec. Grade Duplex - 20 amp	IG-5361	5361-IG	IG5366-SS
Safety Receptacle, Duplex	SG-62HI	SG-62	SG-62

D. Special: Receptacles for special applications shall be as indicated on the Drawings.

2.3 PLUG CAPS: Except for duplex receptacles and cleaning combination receptacles one matching plug cap shall be provided for each receptacle. No plug caps are required for duplex receptacles.

2.4 DEVICE PLATES

A. General: Provide device plates for each switch, receptacle, signal and telephone outlet and special purpose outlet. Do not use sectional gang plates. Provide multi-gang outlet plates for multi-gang boxes. Plates shall be Stainless Steel unless otherwise noted.

B. Exposed: Plates for exposed joint fittings shall match the fittings with edges of plates flush with edges of fittings. Heavy cadmium steel plates with gasket. Plates for cast type boxes at locations subject to wet or rain conditions shall be of cast, vapor tight type. Provide hinged lift covers for devices.

C. Communication: Plates for telephone and signal outlets shall each have a 3/8" bushed opening in the center. Wall plates for push-button and buzzer outlets shall have openings to suit the push buttons and buzzers.

D. Plates for special purpose outlets shall be of a design suitable for the particular applications.

2.5 CLOCK OUTLETS: Flush, single receptacle, regressed in Stainless Steel device plate.

2.6 REMOTELY CONTROLLED SWITCHES OR RELAYS: Electro-magnetically operated, mechanically held unless otherwise required. Rugged construction, substantially made, conforming to NEMA and IEEE test standards for industrial type power relays and the requirements of UL 508, Standards for Safety Lighting Control Equipment. Ratings as indicated on the drawings, suitable for the application. Contacts shall be double break, renewable, solid wiping type, silver to silver or silver Tungsten alloy, self aligning, quick make, quick break, with a minimum inductive load rating of 20 amps. Relays shall be as manufactured by Allen-Bradley, ASCO, Cutler-Hammer, General Electric, Square D, or Cutler-Hammer, equal to ASCO mounting and enclosure.

2.7 MOMENTARY CONTACT SWITCHES: Tumbler type single pole double throw momentary contact for 3 wire connection, with OFF position when tumbler handle is in the center, similar in appearance to the conventional snap switch. Handle or key complete as indicated on the Drawings. 20 ampere at 120-277 volts for control of 30, 60, or 100 ampere remotely controlled switches or relays rated 101 amperes and above. Provide cover plates to match the finish of other conventional snap switch plates in the area. Provide nameplate to identify the circuit or equipment controlled.

2.8 TIME SWITCHES: Automatic, electronic, solid-state, single-throw, single pole, double pole or triple pole in a supplied or NEMA-1 general-purpose enclosure as indicated on the drawings. Provide 24-hour operation with at least three ON-OFF operations per 24 hours period with provisions to eliminate operations on any day or days. 30 amperes heavy-duty contact at the voltage indicated on the Drawings. Provide battery backup power supply with automatic restoration of the normal power supply.

2.9 LIGHTING CONTROL CENTER: Photo-time control of a 7 day time switch, with electronic, solid-state, time switch preventing energization of the circuit for pre-set periods for each day of the week, with provision for omitting selected days. Each control circuit shall contain a manual selector to override automatic function. Contractor circuits shall be capable of 120 amperes in-rush at 120 volt and 55 amperes at 208/277 volt. Control center shall be capable of energizing branch circuits by photo-cell control when natural lighting falls below 25 foot candles.

PART 3 EXECUTION

3.1 DEVICE PLATES: Install with alignment tolerance of 1/16" and all edges in continuous contact with wall surfaces.

END OF SECTION

SECTION 26 16 00

PANELBOARDS

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. General Provisions: Section 260100.

C. Cabinets: Section 261330.

D. Motor and Circuit Disconnects: Section 261700.

E. Fuses: Section 261810.

F. Grounding: Section 264500.

1.2 SUBMITTALS: Submit complete shop drawings with outline dimensions, descriptive literature and complete description of the frame size, trip setting, class and interrupting rating of all overcurrent devices. Identify available space.

PART 2 PRODUCTS

2.1 GENERAL: Dead front, safety type with voltage ratings as scheduled. Panelboards shall be of the type required for the short circuit and duty ratings indicated on the drawings. Panelboards shall be as manufactured by General Electric, ITE, Square D, or Cutler-Hammer and shall be circuit breaker or fusible type as scheduled.

2.2 CABINETS: Each panelboard shall be enclosed in a single sheet metal cabinet with front doors, catches, locks, etc., as specified in Section 261330, Cabinets.

2.3 DOOR-IN-DOOR: Both surface and flush panels shall be door-in-door. The door over the interior of the panel shall be provided with hinge and combined lock and latch. The outside door over the panel gutters shall have a hinge on one side and machine screws into threaded holes in the panelboard cabinet on the other three sides. In order to insure the rigidity of the outside door, surface type panels shall have a 1/2" deep lip bent over all around with the corners welded and ground; or, in the case of flush panels a steel angle frame, equivalent in strength to the bent over lip shall be welded to the inside of the door. The outside door shall be of such size as to allow a minimum of 2-3/4" opening to all four sides of the wiring gutter or as required by NEC All locks shall be keyed alike.

2.4 BREAKERS: Molded-case or combination molded-case and current limited fuses as scheduled or required. Provide quick make and quick break toggle mechanism, inverse time trip characteristics and trip free operation on overload or short circuit. Automatic tripping shall be indicated by a

handle position between the manual OFF and ON position. Provide a trip element for each pole, a common trip bar for all poles and a single molded insulating material handle. Handle ties will not be accepted. Adjustable magnetic trip devices shall be set at the factory to the low trip setting. Provide breaker frame sizes as required for the continuous rating or the interrupting capacity, whichever is larger.

2.5 BOLTED TYPE: Circuit breaker current-carrying connections to the bus shall be of the bolted type, factory assembled. Stab in type not permitted. Provide bus bars for three phase panelboards of the sequence phased type connection and arranged for three-phase, four wire mains, unless otherwise indicated on the Drawings.

2.6 FUSIBLE SWITCH UNITS: Quick make, quick break type with external operation handle suitable for padlocking in OFF position. Provide interlock to prevent opening cover when switch is in ON position unless interlock release is operated. Provide switch frame sizes as required for the continuous rating or the interrupting capacity, whichever is larger. Fusible panelboards shall be UL rated and listed for service entrance where applicable.

2.7 SPACE ONLY: Where "Space Only" is noted on the drawings, provide necessary connectors, mounting brackets, etc., for the future insertion of an overcurrent device.

2.8 DIRECTORIES: Provide circuit directories on the inside face of the door of each panel.

2.9 LABELS: Labels for identifying the breakers shall be engraved laminated plastic strips attached by screws or phenolic buttons or small window frame type. Adhesive stick on labels alone will not be acceptable unless specifically approved.

2.10 SKIRTS: Where noted on the Drawings panelboards shall be skirted with complete metal enclosures and barriers separating the panel interior.

PART 3 EXECUTION

3.1 DIRECTORIES: Provide typewritten circuit descriptions referencing permanent room numbering assigned in lieu of the room numbering shown on the Drawings inserted in plastic holder. Text shall be able to be read entirely without moving the card.

3.2 CIRCUIT NUMBERING: Circuit numbering shown on the Drawings is based on pole position in the panelboard and not consecutive numbering.

3.3 PHASE ROTATION: Phase A, left bus; phase B, center bus; phase C, right bus (front viewing).

END OF SECTION

SECTION 26 17 00

MOTOR AND CIRCUIT DISCONNECTS

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. General Provisions: Section 260100.

C. Grounding: Section 264500.

PART 2 PRODUCTS

2.1 DISCONNECTING MEANS

A. Safety Switches: Fusible or non-fusible Type HD quick break safety switches of the sizes and capacities indicated or required. Raintight enclosures at locations exposed to the weather.

B. Separately Enclosed Motor Snap Switches: Motor snap switches may be used for motor disconnect means, controller and motor overcurrent protection when applicable. These devices shall be horsepower rated and may contain motor running overcurrent protection.

C. Safety Type Disconnecting Switches: Heavy duty, quick make, quick break type, 250 or 600 volt rating as required for the application. Number of poles and ampacity as noted or required by code. Fusible where noted with fuse clips suitable for Buss Fusetron Class R Fuses. Short circuit rating of 200,000 RMS Amperes with CV Class R rejection feature installed in fuseholders. NEMA 1 enclosures for dry locations. NEMA 3 R enclosures for wet locations or at exposed weather locations unless otherwise noted.

2.2 MANUFACTURERS

A. General Electric, ITE, Square D, or Cutler-Hammer.

PART 3 EXECUTION

3.1 DISCONNECT MEANS: Install in each location indicated on the Drawings and elsewhere as required by NEC.

END OF SECTION

SECTION 26 18 10

FUSES

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. General Provisions: Section 260100.

C. Motor and Circuit Disconnect: Section 261700.

D. Grounding: Section 264500.

PART 2 PRODUCTS:

2.1 FUSES

A. General: Dual element, time delay type, based on heavy service, Buss Fusetron, or equal, unless otherwise noted or required for installation.

B. Current Limiting Fuses: Provide where indicated on the Drawings. For individual motor circuit protection, provide fuse sized approximately 125 percent of full load current with 100,000 amperes interrupting capacity. For non-motor feeder protection in conjunction with fused switches, install NEMA Class L fuses sized 125 percent of load current or as required for coordination with air and molded case circuit breakers, shall be furnished by the circuit breaker manufacturer.

C. Above 600 amps; Class L, "Hi-Cap" as manufactured by Bussman or approved equivalent by Chase-Shawmut or Federal Pacific.

D. Below 600 amps, as required by short circuit duty, Class K-1, "Limitron" or class K-5, "Low Peak" or Class K-5, "Fusetron" as manufactured by Bussman or approved equivalent by Chase-Shawmut or Federal Pacific.

E. All switches having current limiting fuses installed shall have a Lamicoid nameplate with white lettering on red background reading:

WARNING, REPLACE ONLY WITH CURRENT
LIMITING FUSES AS ORIGINALLY INSTALLED

2.2 COORDINATION: Coordinate the low voltage fuses required for the project to provide basic selective protection and properly coordinate with the other associated protective equipment.

PART 3 EXECUTION

3.1 COORDINATION: Coordinate the low voltage fuses required for the project to provide basic selection protection and properly coordinate with the other associated protective equipment.

3.2 SPARE FUSES: Furnish one complete spare set of each size of fuses. Deliver to the Owner in the original boxes. It shall consist of 100% fuse replacement for all fuses required for panelboards and safety switches.

END OF SECTION

SECTION 26 45 00

GROUNDING

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. General Provisions: Section 260100.

C. Raceways: Section 261100.

D. Outlet Boxes: Section 261300.

E. Wires and Cables: Section 261200.

F. Wiring Devices: Section 261400.

G. Cabinets: Section 261330.

H. Motor and Circuit Disconnects: Section 261700.

I. Panelboards: Section 261600.

PART 2 PRODUCTS

2.1 Materials, equipment and devices related to the grounding system are specified under other sections of these Specifications.

PART 3 EXECUTION

3.1 GENERAL: Install two separate grounding systems, a service grounding system and an equipment grounding system. The service equipment, conduit systems, supports, cabinets, equipment, and neutral conductor shall be grounded in accordance with the minimum code requirements and as further indicated on the Drawings or as specified. Connect the two grounding systems together only at the main service equipment and at the secondary terminals of transformers creating separately derived distribution systems such as dry-type transformers.

3.2 SERVICE GROUNDING SYSTEM

A. General: The service grounding system is provided for the AC service neutral ground. Current return conductors, such as neutrals of the service entrance, feeder circuits and branch circuits, shall not be used for equipment grounding. Care must be exercised to insure that neutral bars are not bonded to the enclosures of panelboards, etc., which are not part of the

main service equipment. Except for separately derived systems, the neutral conductors shall be grounded only in the main service equipment.

B. Common Ground Point: Establish one common ground point in the main service equipment by interconnecting the insulated neutral bus (or bar), the uninsulated equipment ground bus (or bar), and service grounding electrode conductor.

C. Neutral Disconnecting Means: Install a neutral disconnecting means in the main service equipment for disconnecting and isolating the neutral bus from the common ground. The disconnecting means may be disconnecting links in the interconnection between the insulated neutral and uninsulated equipment ground.

D. Neutral Bars: Provide an insulated neutral bar, separate from the uninsulated equipment ground bar, in all panelboards, transformers, starters, disconnect switches, cabinets, etc., which have neutral connections.

3.3 EQUIPMENT GROUNDING SYSTEM

A. General: Provide a complete equipment grounding system in accordance with the minimum code requirements and as further indicated on the Drawings or specified. The equipment ground (green conductor) consists of metallic connections to ground of non-current-carrying metal parts of the wiring system or apparatus connected to the system. The primary purpose of equipment grounding is to provide greater safety by limiting the electrical potential between non-current-carrying parts of the system and to provide a low impedance path to ground for possible ground fault currents.

B. Common Ground Point: Establish one common ground point as specified elsewhere in this section of the specifications for interconnection of the equipment grounding system and the service grounding electrode conductor.

C. Service Equipment Enclosure: Bond the enclosure of the main service equipment to the uninsulated equipment ground box (or bar) with a conductor or bar sized for 50% of the largest service overcurrent device.

D. Ground Bar: Provide an uninsulated equipment ground bar, separate from any insulated neutral bar, in all panelboards, starters, disconnect switches, cabinets, etc. for grounding the enclosure and for connecting other equipment ground conductors. The ground bar shall be an integrally mounted and braced bus bar in panelboards or a separately mounted bar adequately braced or bolted to the enclosure after thoroughly cleaning both surfaces to assure good contact. Provide solderless pressure connectors for all conductor terminations. Number and size of pressure connectors on equipment grounding bars as required for the termination of equipment grounding conductors. In addition to the active circuits, provide pressure connectors for all three-phase spares and spaces.

E. Conduits: Where metallic conduits terminate without mechanical connection to a metallic housing of electrical equipment by means of lock nut and bushings, provide ground bushing connected with a bare copper conductor to the ground bar in the electrical equipment. Metallic conduits containing ground wiring only shall be bonded to the ground wire at both conduit entrance and exit. Install grounding conductor in each nonmetallic conduit or duct except those used for telephone, sound, or low voltage signals and in all flexible conduit that

does not have a built-in ground conductor. Bond the conductor at both ends to the equipment grounding system.

F. Feeders and Branch Circuits: Provide a separate green insulated equipment grounding conductor for each single or three phase feeder and each branch circuit with a three phase protective device. Provide a separate green insulated equipment grounding conductor for single phase branch circuits where indicated on the Drawings. Install the required grounding conductor in the common conduit or raceway with the related phase and/or neutral conductors and connect to the box or cabinet grounding terminal. Where there are parallel feeders installed in more than one raceway each raceway shall have a green insulated equipment ground conductor installed.

G. Devices: Install a minimum No. 12 green insulated equipment bonding conductor from a grounding terminal in the respective outlet or junction box to the green ground terminal of all receptacles and through flexible conduit to all light fixture housings and other fixed equipment.

H. Motors: Install a separate green insulated equipment grounding conductor from the equipment ground bar in the motor control center or separate starter through the conduit and flexible conduit to the ground terminal in the connection box mounted on the motor. Install the grounding conductor in the common conduit or raceway with the related motor circuit conductors.

3.4 SEPARATELY DERIVED SYSTEMS: Transformers creating separately derived distribution systems, such as dry type transformers, shall utilize the equipment ground bars in the transformer enclosure for both secondary equipment ground and secondary neutral ground with separate grounding conductor extended to an approved ground electrode.

3.5 GROUNDING ELECTRODES: Two service ground electrodes shall be utilized. One shall be the main cold water metallic water piping system and the other shall be a made electrode consisting of not less than twenty feet of bare copper conductor encased along the bottom of a concrete foundation footing which is in direct contact with the earth (NEC 250-H). Make the connections to the cold water pipe inside the building at the point of entrance. The grounding electrode for separately derived systems shall be approved for the application.

3.6 GROUNDING CONDUCTORS: The grounding conductors for both service ground electrodes shall be insulated or bare copper, sized in accordance with NEC 250-94, including the conductor for the made electrode. The conductors shall be continuous without joint or splice and shall be installed in conduit with the conduit bonded to the conductor at each end. Install the conductor to permit the shortest and the most direct path and terminate in the main service equipment on the common ground point. Equipment grounding conductors shall be green insulated conductors equivalent to the insulation on the associated phase conductor, but not less than Type TW. The equipment grounding conductor or straps shall be sized in accordance with NEC. Where one feeder serves a series of panelboards of transformers the equipment grounding conductor shall be continuous without splices. Grounding conductors shall not be installed through metal sheathed holes. All connections shall be available for inspection and maintenance.

3.7 GROUND CONNECTIONS: Clean surfaces thoroughly before applying ground lugs or clamps. If surface is coated the coating must be removed down to the bare metal. After the coating has been removed apply a non-corrosive approved compound to cleaned surface and install lugs or clamps.

Where galvanizing is removed from metal it shall be painted or touched up with "Galvanoz", or equal.

3.8 TESTS

1. Remove all jumpers between the equipment ground busses and the service (neutral) ground busses in the main service panel and all separately derived systems. See Section 3.02.C.

2. For each grounding system, using a megger, measure the resistance between the two ground busses at the panel where the jumper was installed. The resistance shall be greater than 10 megohms.

3. Re-connect the equipment and service bus jumpers on all systems. See Section 3.02.C.

4. For each grounding system, using a megger, measure the resistance between the two ground busses at the panel farthest away (electrically) from the panel where the jumper was installed. The resistance shall be less than 5 ohms.

5. Submit a written report to the Engineer for approval. The service shall not be energized if the test shows more than 5 ohms, unless approved by the Engineer.

END OF SECTION

SECTION 26 50 00

LIGHTING EQUIPMENT

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. General Provisions: Section 260100.

C. Grounding: Section 264500.

D. Lamps: Section 265010.

E. Ballast and Accessories: Section 265020.

F. Fluorescent Fixtures: Section 265110.

1.2 SUBMITTALS

A. Submit for approval complete shop drawings, catalog cut, special installation instruction, photometric data, descriptive literature, and actual fixture when requested by Engineer.

B. Each fixture submittal shall be inclusive of lamp manufacturer's data for lamp to be furnished for each particular fixture. Review of fixtures will not be started until this provision has been met.

1.3 PRIOR APPROVAL: All proposed substitutions to the specified fixtures shall be submitted for approval a minimum of 10 calendar days prior to bid opening. The submittal for approval shall include all data called for in submittals along with an actual fixture proposed to be substituted. When a substitution is accepted as an equal and the substituted fixture is awarded for this Contract as the fixture to be furnished, then the substituted fixture may be retained by the Contractor and shall be the last fixture of that type to be installed on this project. All of the same type fixtures shall be equal to or better than that fixture retained.

PART 2 PRODUCTS

2.1 GENERAL: Furnish all lighting fixtures throughout of the type indicated on the drawings, complete with lamps, sockets, wiring, fitters, hangers, plaster rings, canopies, etc., as required.

2.2 METAL HALIDE FIXTURES: All metal halide fixtures shall be provided with a clear glass lens integral to fixture.

2.3 RECESSED FIXTURES: All recessed fixtures shall be provided with thermal protection as required by National Electrical Code.

PART 3 EXECUTION

3.1 SUPPORTS: Support ceiling fixtures by anchorage to the ceiling only where the ceiling is concrete or masonry units. For ceiling of other construction, anchor ceiling fixtures to metal or wood supports provided for the purpose, of suitable strength and stability, adequately attached to and supported by joists, trusses or other structural members, unless other methods of support are specifically approved by the Engineer. Where lay-in construction is used fixtures shall be of the lay-in type. Fixtures shall be supported at all four corners to structure above. Coordinate supports for lay-in fixtures with ceiling Installer/Sub-Contractor.

3.2 LOW DENSITY CEILING: Special attention is directed to the code restriction against mounting fluorescent fixtures on combustible low density cellulose fiberboard ceilings (NEC 410-77b). If fixtures are to be installed that are not UL approved for this condition a suitable mounting arrangement shall be developed which meets the approval of the Engineer.

3.3 CEILING TRIM AND MEANS OF SUPPORT: The ceiling trim and means of support of recessed fixtures shall be coordinated with the type of ceiling to be installed within or on to insure proper installation.

3.4 SUSPENDED FIXTURES: Provide swivel hangers and canopies to insure a plumb installation. For single unit suspended fluorescent fixtures provide tubing or stems for wiring at one point and a tubing or rod suspension provided for each unit of chassis. Provide 3/16" diameter rods minimum.

3.5 BLOCKING: Protect housing of recessed lighting fixtures during installation by internal blocking or framing to prevent distortion of sides or dislocation of threaded lugs which upon completion must be in perfect alignment and match the corresponding holes in frames or rims so that holding screws can be installed freely without forcing and remain so they can be easily removed when servicing. Threads to receive holding screws shall be chased after plating and finishing to insure easy installation and removal of knurled headed screws by thumb pressure.

3.6 LAMP GUARDS: Provide wire guards on open type fluorescent fixtures to prevent lamps from falling.

3.7 CLEAN UP: At final inspection the fixtures and lighting equipment shall be in first class operating order, in perfect condition as to finish, free from defects, completely lamped, clean and free from dust, plaster or paint spots, and complete with the required glassware, reflectors, side panels, louvers or other components necessary to complete the fixtures.

3.8 CEILING TRIM: Furnish proper ceiling frames for the ceiling material in which recessed fixtures are to be installed, verify prior to ordering. Rims of all fixtures that overlap ceilings shall be installed tight and snug against the ceiling surfaces so that no light leakage occurs around the rim. If unevenness or surface of fixture allows light to show, then this contractor shall provide soft sponge filler or gasket on all fixtures requiring this treatment, and as approved by Engineer.

3.9 FIXTURES

A. Special attention is directed to the special provisions for flush and recessed fixtures in the National Electrical Code.

1. All recessed fixtures shall have top connections to the outlet boxes installed in accordance with the code.

2. Connection to lay in fixtures shall be made with flexible connections of 4'-0" minimum, 6’-0” maximum length. Fixture-to-fixture wiring is not permitted.

1. All recessed fixtures shall be furnished with UL listed thermal protective device.

END OF SECTION

SECTION 26 50 10

LAMPS

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. Grounding: Section 264500.

C. Lighting Equipment: Section 265000.

D. Ballast and Accessories: Section 265020.

PART 2 PRODUCTS

2.1 FLUORESCENT LAMPS: Fluorescent lamps shall be GE 3000 degree K/SP30 or approved equal, energy saving lamps matched for usage to energy saving ballast. The ballast/lamp system shall be capable of providing 6000 initial lumens for two lamps with 75 watts system input.

2.2 INCANDESCENT LAMPS: Incandescent lamps shall be inside frosted, medium base, extended service, 130 volt unless otherwise noted. PAR or R lamps shall be provided if called for on the Drawings.

2.3 MERCURY VAPOR LAMPS: Mercury vapor lamps shall be Deluxe white phosphor coated, mogul base with correlated color temperature of 3900 degree K or as indicated.

2.4 METALLIC HALIDE LAMPS: Metallic halide lamps shall be phosphor coated, mogul base and shall be furnished for proper lamp burning position as determined by fixture installed within. Correlated lamp color temperature shall be as follows:

100 watt 3200 degrees K
175 watt 3200 degrees K
250 watt 3200 degrees K
400 watt 3700 degrees K
1000 watt 3400 degrees K

Color temperature may vary 100 degrees K plus or minus.

2.5 HIGH PRESSURE SODIUM LAMPS: High pressure sodium lamps shall be clear, mogul base with an apparent color temperature of 2100 degree K, or as indicated. Lamps shall be furnished for proper lamp burning position as determined by fixture installed within.

2.6 SAFETY: All Mercury Vapor and Metallic Halide Lamps shall be furnished with a means of immediately extinguishing the lamp when the outer lamp envelope is either penetrated or broken.

2.7 MANUFACTURERS: General Electric, Sylvania, or Cutler-Hammer are approved. Where a specific manufacturer's product is mentioned, then it shall be so furnished.

PART 3 EXECUTION

3. 1 INSTALLATION: The Contractor shall install new lamps in all lighting fixtures. Installation of the new lamps shall be made seven (7) days before final inspection, unless otherwise approved by the Engineer in writing.

END OF SECTION

SECTION 26 50 20

BALLASTS AND ACCESSORIES

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. Grounding: Section 264500.

C. Lighting Equipment: Section 265000.

D. Lamps: Section 265010.

PART 2 PRODUCTS

2.1 GENERAL: Ballast shall be supplied for the voltage that the fixture is connected to. All ballast shall be high power factor and UL listed.

A. Ballasts: Fluorescent ballasts shall be energy savings type and shall be usable with energy savings lamps so that the ballast/lamp system shall be capable of providing 6000 average initial lumens for two lamps at 75 watts of system input. Ballast performance with such lamps shall be certified by ETL or approved equal laboratory with a United States Government Registered Certification Mark for fluorescent lamp ballast. Performance certification with such lamps shall be according to component test method and appear on ballast nameplate; the relative light output shall be 95% with a tolerance of +5% to -2-1/2% and input watts shall be 78 watts with a tolerance of 5%. The ballast case temperature shall not exceed 90 degree C. Ballast shall be UL listed, Class P, Premium. Mercury vapor, metal halide, and high-pressure sodium ballasts shall be manufactured with the following features:

1. .125 minimum thickness extruded aluminum housing with heat dissipating fins.

2. Die cast aluminum end cap closure.

3. Thermally isolated capacitor enclosed in a diecast compartment with easy access for serviceability.

4. Constant auto stabilized, high-power factor.

5. Constant Wattage, auto-stabilized, high power factor. Core and coil encapsulated in a thermally conductive Class F (155 degree C.), insulation material which isolates sound attenuating vibration.

6. Stand-By feature with instant incandescent light from energizing or re-energizing of current to 70% of rated output of HID lamp.

2.2 MANUFACTURERS: Advance, General Electric, Jefferson, Universal, Halo, Prescolite, or approved equal for function specified.

PART 3 EXECUTION

3.1 All ballasts shall be installed within specific fixtures in a manner so as to assure a completely silent operation with attainment of maximum ballast life as specified by the manufacturer.

END OF SECTION

SECTION 26 51 10

FLUORESCENT FIXTURES

PART 1 GENERAL

1.1 RELATED WORK SPECIFIED ELSEWHERE

A. The general provisions of the Contract, including General Conditions, Supplementary General Conditions (if any) and General Requirements apply to the work specified in this section.

B. General Provisions: Section 260100.

C. Raceways: Section 261100.

D. Grounding: Section 264500.

E. Lighting Equipment: Section 265000.

F. Lamps: Section 265010.

G. Ballasts: Section 265020.

1.2 SUBMITTALS: Submit complete shop drawings indicating construction of fixture including lens nominal thickness, photometry's and housing thickness.

PART 2 PRODUCTS

2.1 FLUORESCENT FIXTURES: All fixtures, ballasts and supports shall be quiet in operation. Louvers, shields, reflectors and all sections of the channel structure shall be securely held in position. Fixtures shall not be mounted in such a way that ballast hum will be amplified or transmitted into work areas.

2.2 FINISH: Bonderized or equal treatment on all steel parts prior to applying finish. Metal parts shall be aluminum, brass, copper, bronze or steel, with baked white enamel finish unless otherwise noted on the drawings.

2.3 FLUORESCENT LAMPHOLDERS: Designed so lamps will be held firmly in place, electrically and mechanically permitting easy insertion or removal of lamps. Provide corrosion resistant, silver plated lamp pin contacts.

2.4 LENS: When an acrylic lens or diffuser is specified it shall be molded of 100% Acrylic meeting American Society for Testing materials specifications for Methacrylate Molding and Extrusion Compounds (ASTM D788-63). Plastic diffusing panels, luminous side panels and other luminous plastic members of fixtures shall be made of not less than nominal .125" thick prismatic clear acrylic material. Plastic shall be nonflammable or shall have a flame spread rate of not more than 3.2 inches per minute for a 1/2" width of the material. The plastic shall show no yellowing apparent to the naked eye either when subjected to the accelerated weathering test in accordance

with ASTM D795-44T (500 hours exposure, using type S-1 lamp) or after prolonged exposure to a fluorescent lamp source under conditions identical with those existing in the fixture in which it is to be used. The plastic shall be non-electrostatic or the finished parts shall be treated with an anti-static wax.

2.5 HOUSING: Not less than 20 gauge steel with baked white enamel finish applied over corrosion resistant primer unless otherwise specifically approved.

PART 3 EXECUTION

3.1 LAY-IN FIXTURES: All lay in fixtures shall be adequately supported on all four corners to the structure and not to the ceiling alone.

3.2 SURFACE MOUNTED FIXTURES: All surface mounted fixtures shall be furnished with top plates whenever applicable.

END OF SECTION

SECTION 31 10 00

SITE CLEARING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Removing surface debris.
2. Removing designated paving, curbs, and sidewalks.
3. Removing designated trees, shrubs, and other plant life.
4. Removing abandoned utilities.
5. Excavating topsoil.

B. Related Sections:
1. Section 31 23 17 - Trenching and Backfill

1.2 DEFINITIONS

A. Clearing: Clearing is the removal from the ground surface and disposal of trees, brush, shrubs, down timber, decayed wood, other vegetation, concrete, rubbish, and debris, as well as the removal of fences, stockpiled materials, and incidental structures.

B. Grubbing: Grubbing is the removal and disposal of all stumps, buried logs, roots, matted roots, and organic materials.

1.3 QUALITY ASSURANCE

A. Perform Work in accordance with applicable State of New Mexico Standard Specifications.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 DISPOSITION OF TREES AND SHRUBS

A. General
1. Trees and shrubs within the limits of work shall be removed only where shown on the Drawings. Do not cut or damage trees unless so indicated or unless written permission has been obtained from the affected property owner. Three

copies of such permission shall be furnished to the ENGINEER before removal operations commence.

B. Trees and Shrubs To Be Removed

1. Trees and shrubs felled within the limits of work shall have their stumps grubbed and removed to a licensed disposal site. Depressions created by such removal shall be filled with structural backfill.

3.2 CLEARING AND GRUBBING

A. Clear all items specified herein to the limits indicated or as directed by the ENGINEER and stockpile cleared and grubbed material onsite. Do not start earthwork operations in areas where clearing and grubbing is not complete, with the exception that stumps and large roots may be removed concurrent with excavation. Comply with erosion and sediment control and storm water management measures. Super silt fence shall be installed prior to earth-moving activities.

B. Clear and grub areas to be excavated, areas to receive fill, and areas upon which structures are to be constructed, as directed by the ENGINEER. Remove all trees, stumps, and root mats in these areas and dispose of them offsite at no cost to the property owner. Depressions made by the removal of stumps or roots shall be filled with suitable backfill.

C. The CONTRACTOR shall clear, grub, and strip the site area to the limits of disturbance shown on the Contract Drawings. Clearing and grubbing shall not be performed more than 60 days before excavation is to begin.

END OF SECTION

SECTION 31 23 17

TRENCHING AND BACKFILL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. This Section shall be supplemental to 701 of the New Mexico Standard Specifications for Public Works Construction. Section 701 shall apply except as modified in this Section.

B. Related Sections:
   1. Section 31 10 00 - Site Clearing.
   2. Section 31 23 24 - Flowable Fill

1.2 REFERENCES

A. New Mexico Standard Specifications for Public Works Construction:
   1. Section 701 - Trenching, Excavation and Backfill

1.3 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

B. Trench Zone: The trench zone includes the portion of the trench from the top of the pipe zone to the existing surface in unpaved areas.

C. Pipe Zone: The pipe zone shall include the full width of trench from the bottom of the pipe or conduit to a horizontal level 12 inches above the top of the pipe. Where multiple pipes or conduits are placed in the same trench, the pipe zone shall extend from the bottom of the lowest pipes to a horizontal level 12 inches above the top of the highest or topmost pipe.

D. Pipe Bedding: The pipe bedding shall be defined as a layer of material immediately below the bottom of the pipe or conduit and extending over the full trench width in which the pipe is bedded. Thickness of pipe bedding shall be as shown on the drawings or as described in these specifications for the particular type of pipe installed.

E. Excess Excavated Material
   1. The Contractor shall make the necessary arrangements for and shall remove and dispose of all excess excavated material.
   2. No excavated material shall be deposited on private property unless written permission from the Engineer is secured by the Contractor.

1.4 TRENCH SAFETY

A. All excavations shall be performed, protected, and supported as required for safety. In all cases, Contractor shall ensure that all excavation and trenching methods meet or exceed safety requirements as set forth by local, state and federal agencies.

B. Barriers shall be placed at each end of all excavations and at such places as may be necessary along excavations to warn all traffic of such excavations.

C. No trench or excavation shall remain open and exposed to vehicular or foot traffic during non-working hours. The trench or excavation shall be fenced off, or covered with steel plates, spiked in place, or backfilled.

D. The Contractor shall notify the Engineer of all work-related accidents which may occur to persons or property at or near the project site, and shall provide the Engineer with a copy of all accident reports. All accident reports shall be signed by the Contractor or its authorized representative and submitted to the Engineer within twenty-four (24) hours of the accident's occurrence.

1.5 ACCESS

A. Unobstructed access must be provided to all driveways or other property or facilities that require routine use. Temporary closures of driveways require written approval of the property owner and confirmation from the Engineer.

1.6 PERMITS

A. The Contractor shall keep a copy of all the required permits in the job site and comply with all the terms and conditions of said permits.

1.7 QUALITY ASSURANCE

A. Perform Work in accordance with applicable State of New Mexico Standard Specifications for Public Works Construction.

1.8 COORDINATION

A. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Native Earth Backfill: Native earth backfill, acceptable for use, shall be fine-grained material free from roots, debris, and rocks with a maximum dimension not larger than 3 inches.

B. Imported Backfill Material: Whenever the excavated material is not suitable for backfill, the Contractor shall arrange for and furnish suitable imported backfill material that is capable of attaining the required relative density.

C. Flowable Fill: Flowable fill may be placed as backfill if it meets the requirements of specification section 31 23 24 and approval by the Engineer.

D. The Contractor shall dispose of the excess trench excavation material as specified in the preceding section. Backfilling with imported material shall be done in accordance with the methods described herein.

PART 3 EXECUTION

3.1 COMPACTION REQUIREMENTS

A. Compaction testing will not be required where flowable fill is used as the primary backfill material and as determined by the Engineer.

B. Determine the density of soil in place by the use of a nuclear testing gauge.

C. Determine laboratory moisture-density relations of existing soils by ASTM D698.

D. Determine the relative density of cohesionless soils by ASTM D2049.

E. Sample backfill materials by ASTM D75.

F. Express "relative compaction" as the ratio, expressed as a percentage; of the in place dry density to the laboratory maximum dry density.

G. Compaction shall be deemed to comply with the specifications when no test falls below the specified relative compaction.

H. The Contractor will secure the services of a soils tester and pay the costs of all compaction testing. The Contractor will be responsible for the cost of all retests in failed areas. Test results will be furnished to the Engineer immediately upon conclusion of the test.

I. If the backfill fails to meet the specified relative compaction requirements, the Contractor shall rework the backfill until the requirements are met. The Contractor shall make all necessary excavations for density tests as directed by the Engineer. The Contractor will be responsible for the cost of all additional compaction tests in the reworked areas.

J. Compaction tests shall be performed at 2 foot depths and at 200-foot intervals or as per section A-1 of Standard Specification 701.

K. Unless otherwise shown on the drawings or otherwise described in the specifications for the particular type of pipe installed, relative compaction in pipe trenches shall be as described below:
   1. Pipe zone and pipe base: 90% relative compaction.
   2. Trench zone not beneath paving: 90% relative compaction.
   3. Work performed in roadways shall be done in accordance with section A-1 of Standard Specification 701 and approval of the roadway Owner.

3.2 MATERIAL REPLACEMENT

A. Removal and replacement of any trench and backfill material which does not meet the specifications shall be the Contractor's responsibility.

3.3 TRENCHING

A. Excavation for pipe, fittings, and appurtenances shall be open trench to the depth and in the direction necessary for the proper installation of the facilities as shown on the plans.

B. Trench banks shall be kept as near to vertical as possible and shall be properly braced and sheeted.

3.4 BRACING

A. The Contractor's design and installation of bracing and shoring shall be consistent with OSHA rules, orders, and regulations.

B. Excavations shall be so braced, sheeted, and supported that they will be safe such that the walls of the excavation will not slide or settle and all existing improvements of any kind, either on public or private property, will be fully protected from damage.

C. The sheeting, shoring, and bracing shall be arranged so as not to place any stress on portions of the completed work until the general construction thereof has proceeded far enough to provide ample strength.

D. Care shall be exercised in the drawing or removal of sheeting, shoring, bracing, and timbering to prevent the caving or collapse of the excavation faces being supported.

3.5 TRENCH WIDTHS

A. Excavation and trenching shall be true to line with a minimum width of the largest outside diameter of the pipe + 12 inches and a maximum width of the largest outside diameter of the pipe + 24 inches. Width of trenches for multiple pipes shall be according to the Drawings.

3.6 LENGTH OF OPEN TRENCH

A. The maximum allowable length of open trench shall be the distance necessary to accommodate the amount of pipe installed in a single day.

3.7 GRADE

A. Excavate the trench to the lines and grades shown on the Drawings with allowance for pipe thickness and for pipe base or special bedding.

B. The trench bottom shall be graded to provide a smooth, firm, and stable foundation that is free from rocks and other obstructions and shall be at a reasonably uniform grade.

3.8 CORRECTION OF OVER EXCAVATION

A. Where excavation is inadvertently carried below the design trench depth, suitable provision shall be made by the Contractor to adjust the excavation, as directed by the Engineer, to meet requirements incurred by the deeper excavation.

B. Over excavations shall be corrected by backfilling with approved graded crushed rock or gravel and shall be compacted to provide a firm and unyielding subgrade or foundation, as directed by the Engineer.

3.9 FOUNDATION STABILIZATION

A. Whenever the trench bottom does not afford a sufficiently solid and stable base to support the pipe or appurtenances, the Contractor shall excavate to a depth below the design trench bottom, as directed by the Engineer, and the trench bottom shall be backfilled with 3/4-inch rock and compacted to provide uniform support and a firm foundation.

B. Where rock is encountered, (see Section 3.10 C) it shall be removed to a depth at least 6 inches below grade and the trench shall be backfilled with 3/4-inch crushed rock to provide uniform support and a firm foundation.

C. If excessively wet, soft, spongy, unstable, or similarly unsuitable material is encountered at the surface upon which the bedding material is to be placed, the unsuitable material shall removed to a depth as determined in the field by the Engineer and replaced by crushed rock to provide uniform support and a firm foundation..

3.10 EXCAVATED MATERIAL

A. All excavated material shall not be stockpiled in a manner that will create an unsafe work area or obstruct sidewalks or driveways.

B. In confined work areas, the Contractor may be required to stockpile the excavated material off-site, as determined by the Engineer.

C. Rock excavation is defined as boulders, sedimentary, or igneous rock that cannot be removed without continuous use of pneumatic tools or blasting.

3.11 PLACING OF PIPE BEDDING

A. Place the thickness of pipe bedding material over the full width of trench necessary to produce the required bedding thickness when the material is compacted to the specified

relative density. Grade the top of the pipe bedding ahead of the pipe to provide firm, uniform support along the full length of pipe.

3.12 BACKFILLING WITHIN PIPE ZONE

A. After pipe has been installed in the trench, place pipe zone material simultaneously on both sides of the pipe, keeping the level of backfill the same on each side. Carefully place the material around the pipe so that the pipe barrel is completely supported and that no voids or uncompacted areas are left beneath the pipe. Use particular care in placing material on the underside of the pipe to prevent lateral movement during subsequent backfilling.

3.13 BACKFILLING WITHIN TRENCH ZONE

A. Push the backfill material carefully onto the backfill previously placed in the pipe zone. Do not permit free fall of the material until at least 2 feet of cover is provided over the top of the pipe. Do not drop sharp, heavy pieces of material directly onto the pipe or the tamped material around the pipe.

B. The remaining portion of the trench to the street zone or ground surface, as the case may be, shall be backfilled, compacted and/or consolidated by approved methods to obtain the specified relative compaction.

1. Compaction using vibratory equipment, tamping rollers, pneumatic tire rollers, or other mechanical tampers shall be done with the type and size of equipment necessary to accomplish the work. The backfill shall be placed in horizontal layers of not greater than 12-inches depth. Each layer shall be evenly spread, properly moistened, and compacted to the specified relative density as given on the drawings. The Contractor shall repair or replace any utility, pipe, fittings, manholes, or structures as directed by the Engineer damaged by the Contractor's operations.

3.14 REPLACEMENT OF ASPHALT CEMENT

A. Perform replacement of asphalt cement in accordance with New Mexico Standard Specifications for Public Works Construction, Sectionu 701 and as specified on the Drawings.

END OF SECTION

SECTION 31 23 24

FLOWABLE FILL

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Flowable fill

B. Related Sections:
   1. Section 31 23 17 - Trenching and Backfill.

1.2 REFERENCES

A. ASTM International:
   1. ASTM C33 - Standard Specification for Concrete Aggregates.
   2. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
   3. ASTM C150 - Standard Specification for Portland Cement.
   4. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
   5. ASTM C403/C403M - Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance.
   6. ASTM D4832 - Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.

1.3 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, manhole, tank or cable.

B. Excavatable Flowable Fill: Lean cement concrete fill used where future excavation may be required such as fill for utility trenches, bridge abutments, and culverts.

C. Non-Excavatable Flowable Fill: Lean cement concrete fill used where future excavation is not anticipated such as fill below structure foundations and filling abandoned utilities.

1.4 SUBMITTALS

A. Mix Design:
   1. Submit flowable a fill mix design for each specified strength. Submit separate mix designs when admixtures are require for the following:
      a. Flowable fill work during hot and cold weather;
      b. Air entrained flowable fill work;
      c. Flowable fill for insulation of hot air piping.
   2. Identify design mix ingredients, proportions, properties, admixtures, and tests.

3. Compressive strength at 1 day and 7 days. Report compressive strength of each specimen and average specimen compressive strength.

4. Submit test results to certify flowable fill mix design properties meet or exceed specified requirements.

B. Delivery Tickets:
1. Submit duplicate delivery tickets indicating actual materials delivered to Project site.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not install flowable fill during inclement weather or when ambient temperature is less than 40 degrees F.

1.6 FIELD MEASUREMENTS

A. Verify field measurements before installing flowable fill to establish quantities required to complete the Work.

PART 2 PRODUCTS

2.1 FLOWABLE FILL

A. Flowable Fill: Excavatable type.

2.2 MATERIALS

A. Portland Cement: ASTM C150 Type I/II - Normal/Moderate.

B. Fine Aggregates: ASTM C33.

C. Water: Clean and not detrimental to concrete.

2.3 ADMIXTURES

A. Air Entrainment: ASTM C260.

2.4 MIXES

A. Mix and deliver flowable fill in accordance with ASTM C94/C94M, Option C.

B. Flowable Fill Design Mix:

ITEM	EXCAVATABLE
Cement Content	As specified by manufacturer
Fly Ash Content	As specified by manufacturer

Water Content	As specified by manufacturer
Air Entrainment	15-35 percent
28 Day Compressive Strength	Maximum 100 psi.
Unit Mass (Wet)	80-110 pcf
Temperature, Minimum at point of delivery	50 degrees F

C. Provide water content in design mix to produce self-leveling, flowable fill material at time of placement.

D. Design mix air entrainment and unit mass are for laboratory design mix and source quality control only.

2.5 SOURCE QUALITY CONTROL

A. Test and analyze properties of flowable fill design mix and certify results for the following:
   1. Design mix proportions by weight of each material.
   2. Aggregate: ASTM C33 for material properties and gradation.
   3. Properties of plastic flowable fill design mix including:
      a. Temperature.
      b. Slump.
      c. Air entrainment.
      d. Wet unit mass.
      e. Yield.
      f. Cement factor.
   4. Properties of hardened flowable fill design mix including:
      a. Compressive strength at 1 day and 7 days. Report compressive strength of each specimen and average specimen compressive strength.
      b. Unit mass for each specimen and average specimen unit mass at time of compressive strength testing.

B. Prepare delivery tickets containing the following information:
   1. Project Designation.
   2. Date.
   3. Time.
   4. Class and Quantity of flowable fill.
   5. Actual batch proportions.
   6. Free moisture content of aggregate.
   7. Quantity of water withheld.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify trenching specified in Section 31 23 17 is complete.

B. Verify utility installation is complete and tested before placing flowable fill.

C. Verify excavation is dry.

3.2 PREPARATION

A. Support and restrain utilities and piping to prevent movement and flotation during installation of flowable fill.

B. Protect structures and utilities from damage caused by hydraulic pressure of flowable fill before fill hardens.

C. Protect utilities to prevent intrusion of flowable fill.

3.3 INSTALLATION - FILL, BEDDING, AND BACKFILL

A. Place flowable fill in lifts to prevent lateral pressures from exceeding structural capacity of structures and utilities.

B. Place flowable fill evenly on both sides of utilities to maintain alignment.

C. Place flowable fill to elevations indicated on Drawings without vibration or other means of compaction.

3.4 FIELD QUALITY CONTROL

A. Perform inspection and testing in accordance with ASTM C94/C94M.
   1. Take samples for tests for every 50 cu yd of flowable fill, or fraction thereof, installed each day.
   2. Sample, prepare and test four compressive strength test cylinders in accordance with ASTM D4832. Test one specimen at 3 days, and one at 7 days.
   3. Measure temperature at point of delivery when samples are prepared.

B. Defective Flowable Fill: Fill failing to meet the following test requirements or fill delivered without the following documentation.
   1. Test Requirements:
      a. Minimum temperature at point of delivery.
      b. Compressive strength requirements for each type of fill.
   2. Documentation: Duplicate delivery tickets.

C. The Contractor may cover the flowable fill within 24 hours after placement if a person weighing at least 150 pounds stands on a 4-inch by 4-inch wooden block and does not sink in the material more than 1 inch (NMDOT Standard Specification Section 516.3.3).

3.5 CLEANING

A. Remove spilled and excess flowable fill from Project site.

B. Restore facilities and site areas damaged or contaminated by flowable fill installation to existing condition before installation and as directed by the Engineer.

END OF SECTION

SECTION 44 11 36

SOIL VAPOR EXTRACTION SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes the equipment and installation of a Soil Vapor Extraction (SVE) System.

B. Related Sections:

1. Section 22 05 23 - General Duty Valves
2. Section 22 05 19 - Gauges and Sensors
3. Section 22 05 03.01 - HDPE Piping
4. Section 22 05 03.02 - PVC Piping
5. Section 22 05 03.03 - Steel Piping
6. Section 22 30 10 - High Density Polyethylene Tanks

1.2 Acronym Definitions

A. scfm - standard cubic feet per minute

B. ppmv - parts per million by volume

C. VOC - volatile organic compound

D. TPH - total petroleum hydrocarbons

E. in. - inch

F. HP - horsepower

G. SVE - soil vapor extraction

H. VFD - variable frequency drive

1.3 PERFORMANCE REQUIREMENTS

A. The system shall remove 500 scfm of soil vapor using an SVE system for treatment. The system shall have a minimum of 99.5% removal efficiency of incoming vapor concentrations. Vapor concentrations from the SVE pilot test were as high as 340,000 micrograms per liter. Under no circumstances shall the discharge to the atmosphere, from all vapor streams, exceed the New Mexico Environment Department limits of 10 lbs/hr and 10 tons/year of a regulated air contaminant, using average hourly flow rates

and data from laboratory samples collected by the OWNER, analyzed using standard EPA methods.

1.4 SUBMITTALS

A. The Manufacturer shall submit the following:
1. Shop Drawings: Provide equipment dimensions, process connections, electrical diagrams, piping and instrumentation diagram, and all information necessary to relate the equipment to the specifications.
2. Product Data: Submit system performance, noise data, and removal rates for benzene and gasoline range organics.
3. Design Data: Provide basis of design to include flow rates and removal rates. Include calculations for removal rates.
4. Test Reports: Indicate flow rates, power consumption, and removal rate.
5. Manufacturer's Installation Instructions and Operation Manuals: Submit 1 copy of each equipment's installation instruction and operation manual
6. Manufacturer's Field Reports: Provide data from installed systems with removal rates, operating costs, and length of operation.

1.5 DELIVERY, STORAGE, AND HANDLING

A. The supplier will be responsible for safe and timely transportation of all necessary equipment and appurtenances to the site. The Supplier’s representative on site will inspect for damage and assumes the responsibility for any issues which may arise from equipment transportation.

B. The Contractor will be responsible for providing any equipment required for system unloading and temporary storage.

1.6 ENVIRONMENTAL REQUIREMENTS

A. All equipment supplied should be manufactured to perform in the anticipated weather conditions at the site, which may include low temperatures of 14°F and high temperatures of 100°F.

B. The equipment should be designed to operate at an elevation of 7,000 feet without adverse affect to performance and operation.

1.7 SCHEDULING

A. Schedule for construction, delivery, and startup to be coordinated with the Engineer. The Manufacturer is to provide the initial schedule and any changes.

1.8 COORDINATION

A. Coordinate work with the Engineer and other Contractors as required.

1.9 WARRANTY

A. Furnish one year manufacturer's warranty for complete skids, including blowers, oxidizers, heat exchanger, and all ancillary equipment.

B. Third party provided equipment shall carry a warranty, which is equal to or greater than the original supplier's warranty, in terms of duration and all comprehensive coverage, and be the responsibility of the system Supplier.

1.10 MAINTENANCE SERVICE

A. All necessary labor pertaining to normal operation of the system will be supplied by Supplier personnel at no additional charge to the Owner beyond the lease payment.

PART 2 PRODUCTS

2.1 VAPOR EXTRACTION EQUIPMENT

A. Suppliers:
1. Intellishare Environmental, Inc.
E4803 395th Avenue
Menomonie, WI 54751 USA
Contact: John Strey
Phone: 1.715.233.6115
Fax: 1.715.232.0669
Email: jstrey@intellishare-env.com

2.2 COMPONENTS

A. The SVE system shall consist of skid-mounted assemblies
1. Separate skid-mounted assemblies shall consist of:
a. SVE blower and vapor liquid separator
b. Air injection blower
c. Thermal accelerator
d. Thermal oxidizer
2. Control panels and local instrumentation and controls with the ability to be remotely accessed
3. Interconnected process piping
4. Electrical power connections
5. Natural gas feed connections

B. Skids shall be constructed of a welded steel frame covered by a welded steel plate.

C. SVE and Air Injection Blowers
1. Blowers:
a. The SVE blower shall be a URAI 59 rotary positive displacement blower driven by a 15-hp TEFC variable speed motor and a VFD located at the main control panel.

b. The air injection blower shall be a URAI 59 rotary positive displacement blower driven by a 20-hp TEFC variable speed motor and a VFD located at the main control panel.

2. Filter, Discharge Silencer, Gauges and Sampling Port: A particulate filter shall be located on the inlet of the blower and the discharge of the blower will include a premium chamber discharge silencer, pressure gauge, temperature gauge, and sample port.
3. Vapor Liquid Separator: A vapor liquid separator shall be located on the inlet of the system and provide 50 gallons of accumulated condensate. The vapor liquid separator shall include a liquid coalescing media internal to the separator and external devices will include three point liquid level switches mounted inside a clear PVC site glass. The separator shall have a condensate pump and bottom drain.

D. Thermal Accelerator

1. Oxidizer Reactor: The reactor house shall be constructed of 7 gauge hot rolled carbon steel. All internal reactor wetted surfaces of the unit shall be constructed of ceramic insulation media. The reactor insulation shall be 2,200° F rated ceramic block insulation.
2. Gas Pre-heater: The unit shall be equipped with a direct gas dual fuel fired primary air burner with combustion air blower. The gas pre-heater shall be controlled from a thermocouple and sized to provide sufficient energy to maintain combustion temperature. Flame supervision shall be achieved by use of an UV detector and approved flame safety programmer.
3. Fuel Gas Piping Assembly: The fuel gas piping assembly shall be pre-piped and pre-wired and meet all requirements as specified in NFPA 79, NFPA 86, NFPA 54 and will be suitable for FM approval. Gas piping assembly shall consist of main shut-off, lubricated plug valve, main and pilot fuel gas pressure regulators, main fuel safety and blocking shut-off valves, pilot safety shut-off valve, high and low gas pressure switches, gas control valve with electrically-operated modulating control actuator, leak test cocks and manual ball valves in accordance with NFPA 86, indicating pressure gauges with shut-off cocks for incoming gas pressure, main regulated gas pressure, pilot-regulated gas pressure and burner gas pressure. A flexible connection shall be provided between the fuel gas piping assembly and the burner.
4. Detonation Arrestor: A detonation arrestor shall be installed on the inlet of the oxidizer burner, which will be connected to the high concentration fume stream. The detonation arrestor shall have a thermal link to provide for source isolation in the event of flame propagation.
5. Exhaust Stack: The stack for the discharge of cleaned gases shall be self supporting and made of stainless steel. The stack shall terminate at approximately 17’ AGL and is supplied with sampling ports.
6. Painting: The entire unit shall be cleaned and painted with two part epoxy paint for corrosion protection.
7. Structural: The assembly shall be mounted on an ASTM trussed structural steel base suitable for lifting with a forklift or crane.

8. Tertiary and Combustion Air Fans: Tertiary and combustion air fans shall be a centrifugal type and sized to process the maximum air throughput with minimal resistance to airflow. The fans shall be direct drive.

E. Thermal Oxidizer

1. Oxidizer Reactor: The reactor housing will be constructed of 7 gauge rolled steel. The Inlet and outlet connections are flanged.
2. High Temperature Refractory: All internal reactor surfaces shall be completely insulated with a ceramic insulation media rated for 2200 deg F. A coating shall be applied to the insulation to increase the mechanical integrity and extend the life of the insulation.
3. Gas Pre-Heater: The unit shall come equipped as standard with a direct gas fired air burner with combustion air blower.
4. Fuel Gas Piping Assembly: The fuel gas piping assembly shall be pre-piped. The gas train will meet all code requirements and is suitable for FM approval. All components are rated for outdoor operation and continuous use.
5. Flame Arrestor: A flame arrestor shall be supplied and mounted to the inlet of the oxidizer and utilized to prevent flame propagation to the source. A spiral crimped aluminum element shall be removable for inspection and cleaning.
6. Exhaust Stack: The stack for the discharge of cleaned gases shall be self supporting and made of stainless steel. The stack shall terminate at approximately 15’ AGL and is supplied with sampling ports.

F. Control System

1. Main Control System: A Nema 4 control panel shall be completely assembled, wired and mounted at eye level. Control panel components shall include, power distribution circuit with solid state PID temperature controller, flame safety programmer with built in purge timer, Allen Bradley programmable logic controller with Ethernet card, operator and alarm lights and an hour meter to record system run time. The control panel shall be UL 508 approved as an assembly. All wiring shall be consistent with standards set forth in the NEC.
2. Automatic Purge Control: The oxidizer shall be purged with fresh air prior to the introduction of contaminated vapors per NFPA 86. To accomplish this, the combustion air blower will be enabled for a specified time. Once complete, the system shall enable the pre-heat mode.
3. Temperature Control: Combustion chamber temperature shall be continuously monitored via thermocouple. The thermocouple and digital indicating temperature controller enable a 4-20ma PID loop with the variable frequency tertiary air fan to maintain the combustion chamber set-point temperature.
4. The control panel shall contain an illuminated selector switch indicating power Hand/Off/Auto, status/alarm lights, motor starter, control relays, and terminal blocks factory assembled and tested. The enclosure shall be rated NEMA 4 and constructed of steel.
5. Automatic Shutdown: An emergency shutdown control with high and low mounted LEL sensors will shutdown the entire system should volatile organic concentrations reach 50% of LEL inside the structure housing the SVE system.

G. Telemetry

1. An Allen Bradley RS View Studio shall be provided for SCADA. Remote access shall be accomplished through high speed VPN.
2. The Allen Bradley RS View Studio shall provide a P&ID of the system with data points shown on the P&ID screen.

2.3 ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Electrical Characteristics: In accordance with the components described above, including all motors and controls.

B. Disconnect Switch: Factory mounted disconnect switches on all individual pieces of equipment.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

3.2 INSTALLATION

A. Install in accordance with the approved project plans, including all piping and ancillary equipment.

3.3 FIELD QUALITY CONTROL

A. All installation, field inspecting, testing, adjusting, and balancing shall be performed by the Supplier for the equipment to function as designed.

3.4 SUPPLIER'S FIELD SERVICES

A. The Supplier is responsible for delivery and operation of all vapor extraction and treatment equipment.

B. The supplier will provide 3 days of startup and training, including travel and per diem.

END OF SECTION

Appendix E

Permits

Appendix E1

Air Quality Permit

Mail Application To:		**For Department use only:**
New Mexico Environment Department Air Quality Bureau Permitting Section 1301 Siler Road, Building B Santa Fe, NM 87507-3113 Phone: (505) 476-4300 Fax: (505) 476-4375 www.nmenv.state.nm.us/aqb		AIRS No.:

Universal Air Quality Permit Application

Use this application for NOI, NSR, or Title V sources.

Use this application for: the initial application, modifications, technical revisions, and renewals. For technical revisions, complete Sections, 1-A, 1-B, 2-E, 3, and any other sections that are relevant to the requested action; coordination with the Air Quality Bureau permit staff prior to submittal is encouraged to clarify submittal requirements and to determine if more or less than these sections of the application are needed. Use this application for streamline permits as well.

This application is being submitted as (check all that apply)**:** ☒ Request for a No Permit Required Determination (no fee)
☐ **Updating** an application currently under NMED review. Include this page and all pages that are being updated (no fee required)
Construction Status: ☒ Not Constructed ☐ Existing Permitted Facility ☐ Existing Non-permitted Facility
Minor Source: ☐ a NOI 20.2.73 NMAC ☐ 20.2.72 NMAC application/revision ☐ 20.2.72.300 NMAC Streamline application
Title V Source: ☐ Title V (new) ☐ Title V renewal ☐ TV minor mod. ☐ TV significant mod. TV Acid Rain: ☐ New ☐ Renewal
PSD Major Source: ☐ PSD major source (new) ☐ minor modification to a PSD source ☐ a PSD major modification

Acknowledgements: ☒ I acknowledge that a pre-application meeting is available to me upon request
☐ $500 NSR Permit Filing Fee enclosed OR ☐ The full permit fee associated with 10 fee points (required with streamline applications).
☐ Check No.: Fee not required for Title V. ☐ This facility meets the applicable requirements to register as a Small Business

Citation: Please provide the **low level citation** under which this application is being submitted: **20.2.72.200.A(3) NMAC**
(i.e. an example of an application for a new minor source would be 20.2.72.200.A NMAC, one example of a low level cite for a Technical Revision could be: 20.2.72.219.B.1.b NMAC, or a Title V acid rain cite would be: 20.2.70.200.C NMAC)

Synthetic Minor Source Information: A source is synthetic minor if its uncontrolled emissions are above major source applicability thresholds, but the facility is minor because it has federally enforceable requirements (federal requirements or permit conditions) that limit controlled emissions below major source thresholds. Facilities can be synthetic minor for either Title V (20.2.70 NMAC) or PSD (20.2.74 NMAC) or both. The Department tracks synthetic minor sources that are within 20% of either TV or PSD major source thresholds, referring to these as Synthetic Minor 80 Sources (abbreviated SM80). Please check all that apply:
Prior to this permitting action this source is a ☐ TV major source, ☐ a TV synthetic minor source, ☐ a TV SM80 source.
Prior to this permitting action this source is a ☐ PSD major source, ☐ a PSD synthetic minor source, ☐ a PSD SM80 source.
This permitting action results in a ☐ TV synthetic minor source and/or ☐ PSD synthetic minor source.

Section 1 – Facility Information

Section 1-A: Company Information

AI # (if known): | Updating permit #:N/A

1	Facility Name: Santa Fe County Judicial Complex Soil Vapor Extraction System	Plant primary SIC Code (4 digits):	
2	Owner's name: New Mexico Environment Department Petroleum Storage Tank Bureau	Phone/Fax: 505-476-4397	
a	Mailing Address: 1301 Siler Road Building B, Santa Fe, NM 87507		
b	Plant Street Address (If no facility street address, provide directions from a prominent landmark):		
3	Billing Party: Daniel B. Stephens & Associates	Phone/Fax: 505-822-9400/505-822-8877	
a	Mailing Address: 6020 Academy NE. Suite 100, Albuquerque, NM 87109	E-mail: gpeterson@dbstephens.com	
4	☐ Preparer: ☐ Consultant:	Phone/Fax:	
a	Mailing Address:	E-mail:	

5	Plant Operator: Daniel B. Stephens & Associates		
a	Plant Operator Address: 6020 Academy NE. Suite 100, Albuquerque, NM 87109		
b	Plant Operator Contact: Gundar Peterson	Phone/Fax: 505-822-9400/505-822-8877	
c	Address: 6020 Academy NE. Suite 100, Albuquerque, NM 87109	E-mail: gpeterson@dbstephens.com	
7	Air Permit Contact: Gundar Peterson	Title: Project Engineer	
	E-mail: : gpeterson@dbstephens.com	Phone/Fax: 505-822-9400/505-822-8877	
a	Mailing Address: 6020 Academy NE. Suite 100, Albuquerque, NM 87109		

Section 1-B: Current Facility Status

1	Has this facility already been constructed? ☐ Yes ☒ No	If yes, is it currently operating in New Mexico? ☐ Yes ☒ No
2	Is the plant currently shut down? ☐ Yes ☐ No	If yes, give month and year of shut down (MM/YY):
3	Was this facility constructed before 8/31/1972 and continuously operated since 1972? ☐ Yes ☒ No	
4	If Yes, has this facility been modified (see 20.2.72.7.P NMAC) or the capacity increased since 8/31/1972? ☐Yes ☐No ☒N/A	
5	Does this facility have a Title V operating permit (20.2.70 NMAC)? ☐ Yes ☒ No	If yes, the permit No. is: P-
6	Has this facility been issued a No Permit Required (NPR)? ☐ Yes ☒☐ No	If yes, the NPR No. is:
7	Has this facility been issued a Notice of Intent (NOI)? ☐ Yes ☒ No	If yes, the NOI No. is:
8	Does this facility have a construction permit (20.2.72 NMAC)? ☐ Yes ☒ No	If yes, the permit No. is:
9	Is this facility registered under a General permit (GCP-1, GCP-2, etc.)? ☐ Yes ☒ No	If yes, the registr. No. is:

Section 1-C: Facility Input Capacity & Production Rate

1	What is the facility's maximum input capacity, specify units (reference here and list capacities in Section 20, if more room is required)			
a	Current	Hourly: N/A	Daily: N/A	Annually: N/A
b	Proposed	Hourly: N/A	Daily: N/A	Annually: N/A
2	What is the facility's maximum production rate, specify units (reference here and list capacities in Section 20, if more room is required)			
a	Current	Hourly: N/A	Daily: N/A	Annually: N/A
b	Proposed	Hourly: N/A	Daily: N/A	Annually: N/A

Section 1-D: Facility Location Information

1	Section: 24	Range: 9E	Township: 17N	County: Santa Fe	Elevation (ft): 6980
2	UTM Zone: ☐ 12 or ☒ 13			Datum: ☐ NAD 27 ☒ NAD 83 ☐ WGS 84	
a	UTM E (in meters, to nearest 10 meters): North building: 414682 South building/temp system: 3949398			UTM N (in meters, to nearest 10 meters): North building: 3949460 South building/temp system: 414690	
b	**AND** Latitude (deg., min., sec.): North building: 35° 41' 7.285" South building/temp system: 35° 41' 5.267"			Longitude (deg., min., sec.): North building: 105° 56' 34.369" South building/temp system: 105° 56' 34.045"	
3	Name and zip code of nearest New Mexico town: Santa Fe 87501				

4	Detailed Driving Instructions from nearest NM town (attach a road map if necessary): in historic Santa Fe
5	The facility is 0.0 miles from Santa Fe.
6	Status of land at facility (check one): ☒ Private ☐ Indian/Pueblo ☐ Federal BLM ☐ Federal Forest Service ☒ Other: County, City
7	List all municipalities, Indian tribes, and counties within a ten (10) mile radius (20.2.72.203.B.2 NMAC) of the property on which the facility is proposed to be constructed or operated: Municipalities: Santa Fe. Indian tribes: Tesuque, Nambe. Counties: Santa Fe
8	**20.2.72** NMAC applications **only**: Will the property on which the facility is proposed to be constructed or operated be closer than 50 km (31 miles) to other states, Bernalillo County, or a Class I area (see www.nmenv.state.nm.us/aqb/modeling/class1areas.html)? ☒ Yes ☐ No (20.2.72.206.A.7 NMAC) If yes, list all with corresponding distances in kilometers: Class I areas: Bandelier NM (28.9) and Pecos Wilderness (23.8km)
9	Name nearest Class I area: Pecos Wilderness
10	Shortest distance (in km) from facility boundary to the boundary of the nearest Class I area (to the nearest 10 meters): 23.8 km
11	Distance (meters) from the perimeter of the Area of Operations (AO is defined as the plant site inclusive of all disturbed lands, including mining overburden removal areas) to nearest residence, school or occupied structure: 3 m (north building), 2 m (south building)
12	Is this a stationary portable source as defined in 20.2.72.7.X NMAC? ☐ Yes ☒ No

Section 1-E: Proposed Operating Schedule (The 1-E.1 & 1-E.2 operating schedules may become conditions in the permit.)

1	Facility **maximum** operating ($\frac{\text{hours}}{\text{day}}$): 24	($\frac{\text{days}}{\text{week}}$): 7	($\frac{\text{weeks}}{\text{year}}$): 52	($\frac{\text{hours}}{\text{year}}$): 8766		
2	Facility's maximum daily operating schedule (if less than 24 $\frac{\text{hours}}{\text{day}}$)? Start:	☐AM ☐PM	End:	☐AM ☐PM		
3	Month and year of anticipated start of construction: March 2010					
4	Month and year of anticipated construction completion: May 2010					
5	Month and year of anticipated startup of new or modified facility: May 2010					
6	Will this facility operate at this site for more than one year? ☒ Yes ☐ No Anticipated 1-3 years of operation					

Section 1-F: Other Facility Information

1	Are there any current Notice of Violations (NOV), compliance orders, or any other compliance or enforcement issues related to this facility? ☐ Yes ☒ No If yes, specify:		
a	If yes, NOV date or description of issue:		NOV Tracking No:
b	Is this application in response to any issue listed in 1-F, 1 or 1a above? ☐ Yes ☒ No If Yes, provide the 1c & 1d info below:		
c	Document Title:	Date:	Requirement # (or page # and paragraph #):
d	Provide the required text to be inserted in this permit:		
2	Is air quality dispersion modeling being submitted with this application? ☐ Yes ☒ No		
3	Does this facility require an "Air Toxics" permit under 20.2.72.400 NMAC & 20.2.72.502, Tables A and/or B? ☐ Yes ☒No		
4	Will this facility be a source of federal Hazardous Air Pollutants (HAP)? ☐ Yes ☒ No		
a	If Yes, what type of source? ☐ **Major** (☐ ≥10 tpy of any single HAP **OR** ☐ ≥25 tpy of any combination of HAPS) **OR** ☐ **Minor** (☐ <10 tpy of any single HAP **AND** ☐ <25 tpy of any combination of HAPS)		
b	If 4.a is Yes, indentify the subparts in 40 CFR 61 & 40 CFR 63 that apply to this facility (If no subparts apply, enter "N/A."): N/A		

Section 1-G: Streamline Application (This section applies to 20.2.72.300 NMAC Streamline applications only)

1	☐ I have filled out Section 18, "Addendum for Streamline Applications." ☒ N/A (This is not a Streamline application.)

Section 1-H: Title V Specific Information

(Fill this section out only if this is a Title V application.)

1	Responsible Official (20.2.70.300.D.2 NMAC):		Phone:
a	R.O. Title:	R.O. e-mail:	
b	R. O. Address:		
2	Alternate Responsible Official (20.2.70.300.D.2 NMAC):		Phone:
a	A. R.O. Title:	A. R.O. e-mail:	
b	A. R. O. Address:		
3	Company's State of Incorporation or Registration to do Business:		
4	Company's Corporate or Partnership Relationship to any other Air Quality Permittee (List the names of any companies that have operating (20.2.70 NMAC) permits and with whom the applicant for this permit has a corporate or partnership relationship):		
5	Name of Parent Company ("Parent Company" means the primary name of the organization that owns the company to be permitted wholly or in part.):		
a	Address of Parent Company:		
6	Names of Subsidiary Companies ("Subsidiary Companies" means organizations, branches, divisions or subsidiaries, which are owned, wholly or in part, by the company to be permitted.):		
7	Affected Programs to include Other States, local air pollution control programs (i.e. Bernalillo) and Indian tribes: Will the property on which the facility is proposed to be constructed or operated be closer than 80 km (50 miles) from other states, local pollution control programs, and Indian tribes and pueblos (20.2.70.402.A.2 and 20.2.70.7.B)? If yes, state which ones and provide the distances in kilometers:		

Section 1-I – Submittal Requirements

A 20.2.73 NMAC (NOI), a 20.2.70 NMAC (Title V), a 20.2.72 NMAC (NSR), or 20.2.74 NMAC (NSR) application package shall consist of the following:

1) One hard copy **original signed and notarized application package** printed double sided 'head-to-toe' as we bind the document on top, not on the side; except Section 2 (landscape tables), which should be head-to-head. If 'head-to-toe printing' is not possible, print single sided. Please use numbered tab separators in the hard copy submittal(s) as this facilitates the review process.
2) If the application is for a NSR or Title V permitting action, include one working hard **copy** for Department use. Technical revisions only need to fill out Section 1-A, 1-B, 3, and should fill out those portions of other Section(s) relevant to the technical revision. TV Minor Modifications need only fill out Section 1-A, 1-B, 1-H, 3, and those portions of other Section(s) relevant to the minor modification. NMED may require additional portions of the application to be submitted, as needed.
3) The entire NOI or Permit application package, including the full modeling study, should be submitted electronically on compact disk(s) (CD). Two CD copies are required (in sleeves, not crystal cases, please), with additional CD copies as specified below.
4) If air dispersion modeling is required, include one additional electronic copy of the air dispersion modeling including the input and output files. The dispersion modeling *summary report only* should be submitted as hard copy(ies) unless otherwise indicated by the Bureau. The complete dispersion modeling study, including all input/output files, should be submitted electronically as part of the electronic submittal.
5) If subject to PSD review under 20.2.74 NMAC (PSD) include,
   a. one additional hard copy and one additional CD copy for US EPA,
   b. one additional hard copy and one additional CD copy for each federal land manager affected (NPS, USFS, FWS, USDI) and,
   c. one additional hard copy and one additional CD copy for each affected regulatory agency other than the Air Quality Bureau.

Electronic Submittal Format [in addition to the required hard copy(ies)]:

1) All required electronic documents shall be submitted in duplicate (2 separate CDs). The documents should be submitted in Microsoft Office compatible file format (Word, Excel, etc.) allowing us to access the text in the documents (copy & paste). Any documents that cannot be submitted in a Microsoft Office compatible format shall be saved as a PDF file from within the electronic document that created the file. If you are unable to provide Microsoft office compatible electronic files or internally generated PDF files of files (items that were not created electronically: i.e. brochures, maps, graphics, etc,), submit these items in hard copy format with the number of additional hard copies corresponding to the number of CD copies required.
2) It is preferred that this application form be submitted as 3 electronic files (2 MSWord docs: Universal Application section 1 and Universal Application section 3-19) and 1 Excel file of the tables (Universal Application section 2) on the CD(s). Please include as many of the 3-19 Sections as practical in a single MS Word electronic document. Create separate electronic file(s) if a single file becomes too large or if portions must be saved in a file format other than MS Word.
3) The electronic file names shall be a maximum of 25 characters long (including spaces, if any). The format of the electronic Universal Application shall be in the format: "A-3423-FacilityName". The "A" distinguishes the file as a application submittal, as opposed to other documents the Department itself puts into the database. Thus, all electronic application submittals should begin with "A-". Modifications to existing facilities should use the core permit number (i.e. '3423') the Department assigned to the facility as the next 4 digits. Use 'XXXX' for new facility applications. The format of any separate electronic submittals (additional submittals such as non-Word attachments, re-submittals, application updates) and Section document shall be in the format: "A-3423-9-description", where "9" stands for the section # (in this case Section 9-Public Notice). Please refrain, as much as possible, from submitting any scanned documents as this file format is extremely large, which uses up too much storage capacity in our database. Please take the time to fill out the header information throughout all submittals as this will identify any loose pages, including the Application Date (date submitted) & Revision # (0 for original, 1, 2, etc.; which will help keep track of subsequent partial update(s) to the original submittal. The footer information should not be modified by the applicant.

Table of Contents

Table 2-H: Stack Exit Conditions

Unit and stack numbering must correspond throughout the application package.

Stack Number	Serving Unit Number(s) from Table 2-A	Orientation (H-Horizontal V=Vertical)	Rain Caps (Yes or No)	Height Above Ground (ft)	Temp. (F)	Flow Rate		Moisture by Volume (%)	Velocity (ft/sec)	Inside Diameter or L x W (ft)
						(acfs)	(SCFS)			
1	1	V	Y	13.6	1450	5	4	0	3.6	2 x 0.75
2	2	V	Y	17.0	1400	9	7	0	2.8	2.0
3	3	V	Y	15.0	1400	9	7	0	2.8	2.0

Section 3

Application Summary

The **Application Summary** shall include a brief description of the facility and its process, the type of permit application, the applicable regulation (i.e. 20.2.72.200.A.X, or 20.2.73 NMAC) under which the application is being submitted, and any air quality permit numbers associated with this site. If this facility is to be collocated with another facility, provide details of the other facility including permit number(s). In case of a revision or modification to a facility, provide the lowest level regulatory citation (i.e. 20.2.72.219.B.1.d NMAC) under which the revision or modification is being requested. Also describe the proposed changes from the original permit, how the proposed modification will effect the facility's operations and emissions, de-bottlenecking impacts, and changes to the facility's major/minor status (both PSD & Title V).

Routine or predictable emissions during Startup, Shutdown, and Maintenance (SSM): Provide an overview of how SSM emissions are accounted for in this application. Refer to "Guidance for Submittal of Startup, Shutdown, Maintenance Emissions in Permit Applications (http://www.nmenv.state.nm.us/aqb/permit/app_form.html) for more detailed instructions on SSM emissions.

This is an application for a No Permit Required (NPR) determination. The application is for a new, minor source (NMAC 20.272.200.A), which will discharge a maximum of 2 tons per year of volatile organic carbons (VOC)s.

This facility is a temporary soil vapor extraction (SVE) system used to remediate subsurface VOCs. The VOCs are in liquid and vapor phases in the subsurface. A vacuum is applied to the subsurface to volatilize organic carbons in the gasoline range. The VOC vapors are incinerated in the internal combustion engine that is applying the vacuum to the subsurface.

The project will be implemented in three phases: temporary, Phase I, and Phase II.

The temporary phase will be built and begin operation in April 2010. It will consist of temporary piping from the vertical SVE wells on the south side of the site to a trailer-mounted thermal oxidizer owned by the New Mexico Environment Department, which is rated to remove 99% of the gasoline vapors that enter the engine. This system will be operational during the construction of the components for Phase I. Once the Phase I components are installed, the temporary SVE system will be dismantled and the SVE wells will be permanently connected to the south compound (see attached plot layout). The temporary system will operate for approximately 3 months.

During Phase I operations, the two horizontal wells and two vertical wells on the north end of the site will be connected to an Intellishare thermal accelerator. Six vertical extraction wells on the south end of the site will be connected to an Intellishare thermal oxidizer. The design extraction rate from both systems is 650 scfm, 400 scfm from the north site and 250 scfm from the south site. The Intellishare thermal accelerator and oxidizer are rated to remove 99% of the contaminates entering the system. This phase will operate for approximately 1 year or less.

After Phase I operation, the north site will be completely dismantled and the two horizontal extraction wells will be connected to the south site. The design extraction rate from the south site for Phase II is 400 scfm. This phase will operate for approximately 2 years.

SSM emissions are not accounted for in this application as the system design prevents the possibility of SSM emissions because the furnace that is consuming the contaminant wired to the blower that is extracting the contaminant. If the furnace stops functioning the whole system shuts down.

Section 4

Process Flow Sheet

A **process flow sheet** and/or block diagram indicating the individual equipment, all emission points and types of control applied to those points. The unit numbering system should be consistent throughout this application.

For the process flow sheet, please see drawing M-1 of the attached plan set.

B-1
COMBUSTION AIR BLOWER
PROVIDED BY INTELLISHARE
1.5 HP 230 VAC/3 PH/60 HZ

B-1A
TERTIARY AIR BLOWER
PROVIDED BY INTELLISHARE
2 HP 230 VAC/3 PH/60 HZ

B-2
COMBUSTION AIR BLOWER
PROVIDED BY INTELLISHARE
3 HP 230 VAC/3 PH/60 HZ

B-3
SVE BLOWER
PROVIDED BY INTELLISHARE
DRESSER ROOTS URAI 59
VACUUM ROTARY
POSITIVE DISPLACEMENT BLOWER
400 SCFM @ 75" H20 VACUUM
SEALED BEARINGS, VARIABLE DRIVE
15 HP 230 VAC/3 PH/60 HZ

B-4
AIR INJECTION BLOWER
PROVIDED BY INTELLISHARE
ROOTS RAI-G, 47U, ROTARY LOBE
250 SCFM @ 5 PSIG
@ 7100 FT MSL AND 100°F
SEALED BEARINGS, VARIABLE DRIVE
20 HP 230 VAC/3 PH/ 60 HZ

C-1
THERMAL ACCELERATOR
PROVIDED BY INTELLISHARE
500 SCFM
1400-1800 DEGREES F
0.15-1.8 MBTU/Hr

C-2
THERMAL OXIDIZER
PROVIDED BY INTELLISHARE
500 SCFM
1400-1600 DEGREES F
MAX 50% LEL
OPTIONAL CATALYST

C-3
HEAT EXCHANGE MODULE
PROVIDED BY INTELLISHARE
300 SERIES STAINLESS STEEL
275 SCFM @ 5 PSIG, 500° F

C-4
BAKER FURNACE TRAILER-MOUNTED THERMAL OXIDIZER
PROVIDED BY NMED
300 SCFM @ 100" H_2O
1450 DEGREES F MAX 50% LEL

P-1
CONDENSATE TRANSFER PUMP
PROVIDED BY INTELLISHARE
GOULDS MODEL NPE
10 GPM, 7.5 PSI
0.75 HP 230 VAC/3 PH/60 HZ
4½" IMPELLER DIAMETER

S-1
VAPOR/LIQUID SEPARATOR
PROVIDED BY INTELLISHARE
50 GALLON NOMINAL

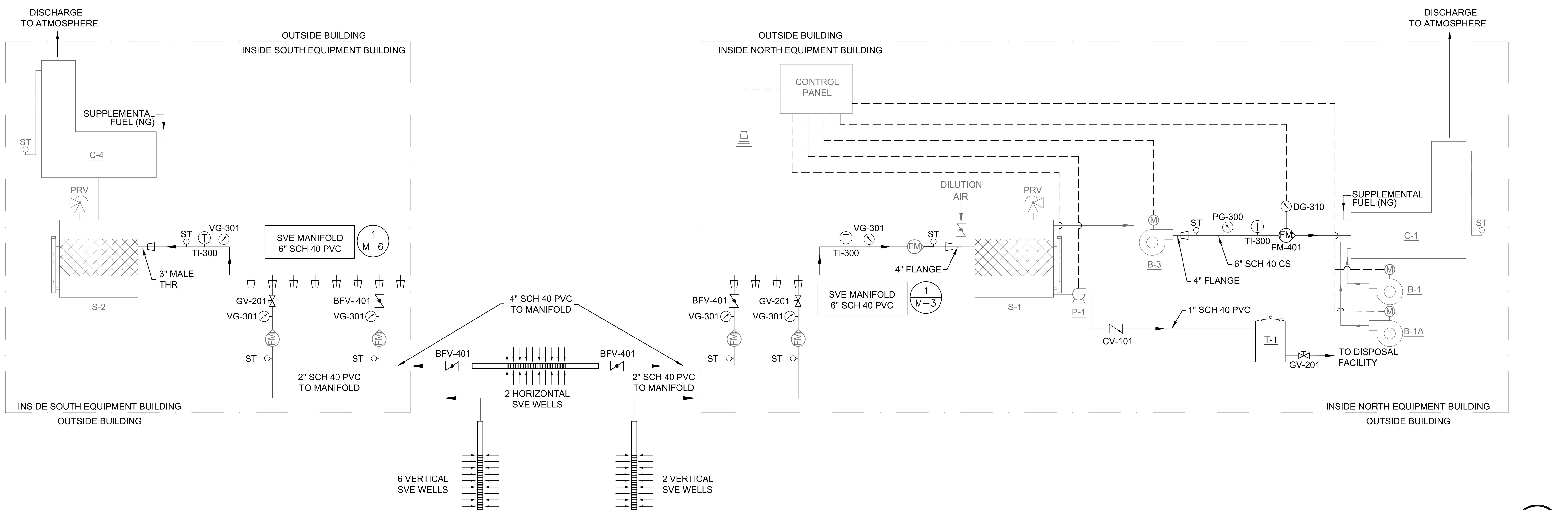
S-2
VAPOR/LIQUID SEPARATOR
PROVIDED BY NMED
50 GALLON NOMINAL

T-1
CONDENSATE STORAGE TANK
300 GALLON POLYETHYLENE
35" DIA, 80" HIGH

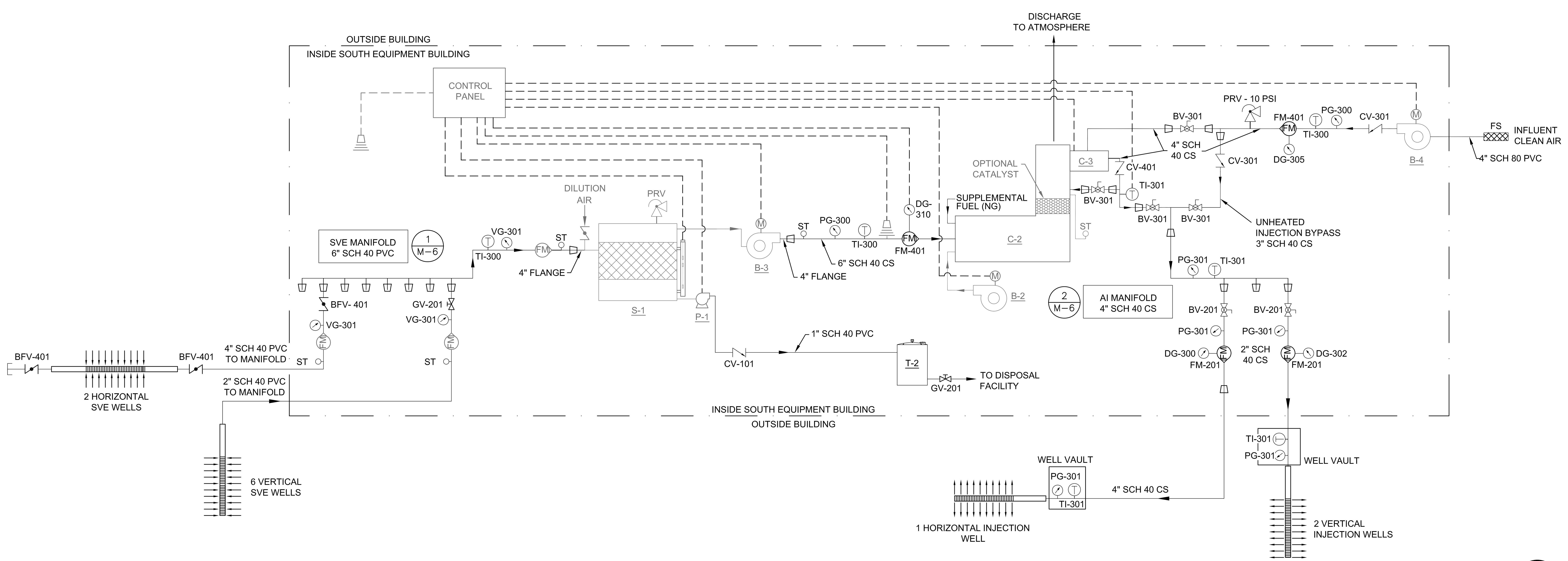
T-2
CONDENSATE STORAGE TANK
300 GALLON POLYETHYLENE
35" DIA, 80" HIGH

NORTH EQUIPMENT BUILDING
35' x 20' x 10' HIGH
TEMPORARY STRUCTURE,
NO CONCRETE SLAB,
6" THICK WALLS
60 dB± SOUND INSULATION

SOUTH EQUIPMENT BUILDING
30' x 17' x 12' HIGH
TEMPORARY STRUCTURE,
NO CONCRETE SLAB,
6" THICK WALLS
60 dB± SOUND INSULATION



PROCESS AND INSTRUMENTATION DIAGRAM - PHASE 1 (1, M-3, M-6)
NTS



PROCESS AND INSTRUMENTATION DIAGRAM - PHASE 2 (2, -)
NTS

ABBREVIATION KEY

AI	AIR INJECTION
BFV	BUTTERFLY VALVE
BV	BALL VALVE
CS	CARBON STEEL
CV	CHECK VALVE
DG	DIFFERENTIAL PRESSURE GAUGE
DIA	DIAMETER
DR	DIAMETER RATIO
F	FARENHEIT
FM	FLOW METER
FS	FILTER SILENCER
GV	GATE VALVE
HDPE	HIGH DENSITY POLYETHYLENE
M	MOTOR
MBTU/Hr	MILLION BRITISH THERMAL UNITS PER HOUR
NG	NATURAL GAS
PG	PRESSURE GAUGE
PRV	PRESSURE RELIEF VALVE
PSIG (GAUGE)	POUNDS PER SQUARE INCH
PVC	POLYVINYL CHLORIDE
SCH	SCHEDULE
SVE	SOIL VAPOR EXTRACTION
ST	SAMPLE TAP
TI	TEMPERATURE INDICATOR
VG	VACUUM GAUGE

SYMBOL LEGEND

- BALL VALVE
- BUTTERFLY VALVE
- CHECK VALVE
- ELECTRICAL
- FLOW METER
- GATE VALVE
- LEL SENSOR
- MOTOR
- PRESSURE RELIEF VALVE
- PRESSURE/VACUUM GAUGE
- REDUCING FITTING
- SAMPLE TAP
- SYSTEM FLOW DIRECTION
- TEMPERATURE GAUGE

GENERAL NOTES:

1. VALVE AND GAUGE IDENTIFIER REFERS TO SCHEDULE IN ASSOCIATED TECHNICAL SPECIFICATION.
2. GREY SHADING INDICATES EQUIPMENT PROVIDED BY VENDOR AS INDICATED IN THE EQUIPMENT SCHEDULE.
3. CONTRACTOR TO INSTALL AND MAKE ALL CONNECTIONS FOR A FULLY FUNCTIONING SYSTEM.

NO | DATE | BY | REVISION MADE

FILE NAME:

Daniel B. Stephens & Associates, Inc.
ENVIRONMENTAL SCIENTISTS & ENGINEERS
6020 ACADEMY NE, SUITE 100
ALBUQUERQUE, NM 87109
(505) 822-9400

DESIGNED BY: GP/TG
DRAWN BY: CS
CHECKED BY: GH/GP
DATE: 2/16/2010

SANTA FE COUNTY JUDICIAL COMPLEX
SANTA FE, NEW MEXICO

PROCESS AND INSTRUMENTATION DIAGRAM

GUNDAR PETERSON
NEW MEXICO
16038
LICENSED PROFESSIONAL ENGINEER

JOB NO.
ES09.0215

SHEET 9 of 22
DWG NO. M-1

XREF:

Section 5

Plot Plan Drawn To Scale

A **plot plan drawn to scale** showing emissions points, structures, tanks, and fences of property owned, leased, or under direct control of the applicant. The unit numbering system should be consistent throughout this application.

For the plot plan drawn to scale please see drawing G-2 in the attached plan set.

NORTH
0 30 ft

SYMBOL LEGEND

- MONITOR WELL
- SVE WELL
- PROPOSED SVE WELL
- PROPOSED AIR INJECTION WELL
- PROPOSED HORIZONTAL SVE WELL
- PROPOSED HORIZONTAL AIR INJECTION WELL

GENERAL NOTES:

1. NATURAL GAS SERVICE LINE SHALL BE INSTALLED BY A LICENSED PLUMBER.
2. CONCRETE BOLLARDS SHALL BE INSTALLED 1' OUTSIDE THE ROLL-UP DOOR AND 1' FROM THE EXTERIOR WALL.
3. TEMPORARY CONSTRUCTION FENCE SHALL BE INSTALLED WITH A SWING GATE IN FRONT OF THE BUILDING ROLL-UP DOOR AND A MANWAY GATE IN FRONT OF THE BUILDING MANWAY DOOR.

XREF:

NO	DATE	BY	REVISION MADE

FILE NAME: S:\Projects\ES.0215_Montezuma_Remediation\04-Drawings\2010_0216\ES0215-GS-Site_Plan.dwg

Daniel B. Stephens & Associates, Inc.
ENVIRONMENTAL SCIENTISTS & ENGINEERS
6020 ACADEMY NE, SUITE 100
ALBUQUERQUE, NM 87109
(505) 822-9400

DESIGNED BY: GP/TG	CHECKED BY: GH/GP
DRAWN BY: CS	DATE: 2/16/2010

SANTA FE COUNTY JUDICIAL COMPLEX
SANTA FE, NEW MEXICO

GENERAL SITE PLAN

GUNDAR PETERSON
NEW MEXICO
16038
LICENSED PROFESSIONAL ENGINEER

JOB NO. ES09.0215

SHEET 3 of 22
DWG NO. G-2

Section 6

All Calculations

All calculations used to determine both the hourly and annual controlled and uncontrolled emission rates. Document the source of each emission factor used (if an emission rate is carried forward and not revised, then a statement to that effect is required). If identical units are being permitted and will be subject to the same operating conditions, submit calculations for only one unit and a note specifying what other units to which the calculations apply. All formulas and calculations used to calculate emissions must be submitted. The "Calculations" tab in the UA2 has been provided to allow calculations to be linked to the emissions tables. Add additional "Calc" tabs as needed. If the UA2 or other spread sheets are used, all calculation spread sheet(s) shall be submitted electronically in Microsoft Excel compatible format so that formulas and input values can be checked. Format all spread sheets and calculations such that the reviewer can follow the logic and verify the input values. Define all variables. If calculation spread sheets are not used, provide the original formulas with defined variables. Additionally, provide subsequent formulas showing the input values for each variable in the formula. All calculations, including those calculations are imbedded in the Calc tab of the UA2 portion of the application, the printed Calc tab(s), should be submitted under this section.

Tank Flashing Calculations: The information provided to the AQB shall include a discussion of the method used to estimate tank-flashing emissions, relative thresholds (i.e., NOI, permit, or major source (NSPS, PSD or Title V)), accuracy of the model, the input and output from simulation models and software, all calculations, documentation of any assumptions used, descriptions of sampling methods and conditions, copies of any lab sample analysis.

SSM Calculations: It is the applicant's responsibility to provide an estimate of SSM emissions or to provide justification for not doing so. In this Section, provide emissions calculations for Startup, Shutdown, and Routine Maintenance (SSM) emissions listed in the Section 2 SSM Table and the rational for why the others are reported as zero (or left blank in the SSM Table). Refer to "Guidance for Submittal of Startup, Shutdown, Maintenance Emissions in Permit Applications (http://www.nmenv.state.nm.us/aqb/permit/app_form.html) for more detailed instructions on calculating SSM emissions. If SSM emissions are greater than those reported in the Section 2, Requested Allowables Table, modeling may be required to ensure compliance with the standards whether the application is NSR or Title V. Refer to the Modeling Section of this application for more guidance on modeling requirements.

Please see attached calculations beginning on the next page.

Tank flashing and SSM calculations are not required for this project.

Calculation Cover Sheet

Daniel B. Stephens & Associates, Inc.

Project Name SFCJC SVE System Project Number ES09.0215

Calculation Number ES09.0215-008 Discipline Engineering No. of Sheets 4

PROJECT: Santa Fe County Judicial Complex SVE System	
SITE: Santa Fe County Judicial Complex , Santa Fe, New Mexico	
SUBJECT: Determination of emission rates	
SOURCES OF DATA:	A. Summary table of laboratory results taken from DBS&A SVE Pilot test report (December 2009) and Addendum (January 2010) B. AcuVac SVE Pilot Test Reports, November and December 2009
SOURCES OF FORMULAE & REFERENCES:	1. Cut sheets and quotes for Intellishare SVE equipment 2. Cut sheet for Baker SVE equipment 3. Selecting the Appropriate Abatement Technology, Kroopnick, Dr. Peter M., Pollution Engineering, November 1998 4. NMED AQB, "Overview & Guidance to New Mexico NSR Air Permitting Requirements"

☐ Preliminary Calculation ☒ Final Calculation Supersedes Calculation No. _____

Rev. No.	Revision	Calculation By	Date	Checked By	Date	Approved By	Date
		KI	02/11/10		2/12/10		2/12/10

Project No. ES09.0215 Date 02/11/2010

Subject Determination of emission rates Sheet 1 of 4

By KI Checked By Calculation No.

1.0 OBJECTIVES

Determine the potential emission rate of benzene, toluene, ethyl benzene, xylene, and volatile organic carbons (gasoline) from the soil vapor extraction system in pounds per hour and tons per year.

2.0 GIVEN

Sample soil vapor concentrations[A] and measured flow rate during the November and December 2009 SVE pilot tests completed by AcuVac[B]. Design flow rate for the temporary system run by the Baker Furnace trailer mounted thermal oxidizer is 250 scfm. The design flow rates for Phase I are 250 scfm for the Intellishare thermal oxidizer and 400 scfm for the Intellishare thermal accelerator. The design flow rate for Phase II is 400 scfm for the Intellishare thermal oxidizer. The destruction efficiency of all equipment is 99 percent[1,2].

3.0 METHOD

To calculate the potential emission rate of each constituent, the influent concentration to the SVE equipment is determined from the laboratory results. The influent concentration is determined by a flow-weighted average of the measured concentrations[A] and extraction well flow rates[B] with

$$\frac{Conc_{SVE9}*Flow_{SVE9} + Conc_{SVE5}*Flow_{SVE5} + Conc_{SVE3}*Flow_{SVE3}}{Flow_{SVE9} + Flow_{SVE5} + Flow_{SVE3}} = \text{influent concentration} \quad \text{[eqn 1]}$$

The effluent concentration is determined by reducing the influent concentration by 99 percent per the manufacturer's specifications[1,2].

$$\text{effluent concentration} = (0.01)*\text{influent concentration} \quad \text{[eqn 2]}$$

The emission rate is calculated by multiplying the effluent concentration by the design flow rate for each piece of SVE equipment and appropriate conversion factors to achieve pounds per hour

$$\text{Concentration}\frac{\mu g}{L} * \text{Flow rate}\frac{ft^3}{min} * \frac{1g}{1000\mu g} * \frac{1lb}{454g} * \frac{60min}{1hr} * \frac{28.3L}{ft^3} = \text{Emission rate}\frac{lb}{hr} \quad \text{[eqn 3]}$$

The emission rate is converted to tons per year by assuming the system runs for 8760 hours per year per NMED AQB guidance[5]

$$\text{Emission rate}\frac{lb}{hr} * \frac{ton}{2000lb} * \frac{8760hr}{year} = \text{emission rate}\frac{ton}{year} \quad \text{[eqn 4]}$$

4.0 SOLUTION

The measured concentrations of benzene, ethyl benzene, toluene, xylene, and volatile organic compounds (in this case, TPH(GRO)) are given in the attached lab reports[A]. The average values of three samples at each well for each compound (SVE-9, SVE-5, SVE-3) are summarized in Table 1.

Table 1: Summary of extraction well average concentration in µg/L for each constituent

Well	Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Total Xylenes µg/L	VOC µg/L
SVE9	2,367	4,100	433	1,633	303,333
SVE5	97	273	81	323	23,667
SVE3	147	410	65	217	38,667

The measured flow rate during SVE pilot testing[B] for extraction well SVE-9 was 5 cfm, for SVE-5 was 34 cfm, and for SVE-3 was 30 cfm. The flow weighted average influent concentration of benzene is calculated with equation 1.

$$\frac{\frac{2{,}367\mu g}{L} * \frac{5\,ft^3}{\min} + \frac{97\mu g}{L} * \frac{34\,ft^3}{\min} + \frac{147\mu g}{L} * \frac{30\,ft^3}{\min}}{\frac{5\,ft^3}{\min} + \frac{34\,ft^3}{\min} + \frac{30\,ft^3}{\min}} = 283\frac{\mu g}{L}$$

The flow weighted average influent concentration of each constituent calculated with the equation 1are given in Table 2. All SVE equipment has greater than 99 percent destruction efficiency[1,2]. As an example calculation the effluent concentration of benzene calculated by equation 2 is

$$\frac{283\mu g}{L} * (0.01) = \frac{3\mu g}{L}$$

The effluent concentration of each constituent from each SVE unit is given in Table 2.

Table 2: Summary of influent and effluent concentrations in µg/L for each constituent

Average concentration	Benzene µg/L	Toluene µg/L	Ethylbenzene µg/L	Total Xylenes µg/L	VOC µg/L
Influent	283	610	100	372	50,454
Effluent	3	6	1	4	505

The effluent concentration of benzene is converted to an emission rate from the temporary system (Baker thermal oxidizer) by utilizing the design flow rate of 250 scfm in equation 3.

$$3\frac{\mu g}{L} * 250\frac{ft^3}{\min} * \frac{1g}{1x10^6\,\mu g} * \frac{1lb}{454g} * \frac{60\min}{1hr} * \frac{28.3L}{ft^3} = 0.003\frac{lb}{hr}$$

The emission rate in pounds per hour is converted to tons per year by equation 4.

$$0.003\,\frac{lb}{hr} * \frac{ton}{2000lb} * \frac{8760hr}{year} = 0.012\frac{ton}{year}$$

The emission rate in pounds per hour and tons per year for each constituent and each phase is given in Table 3.

Table 3: Emission rates by SVE equipment type

SVE Equipment Type	Flow rate scfm	Emission Rate Benzene	Toluene	Ethylbenzene	Total Xylenes	TPH (GRO)	Units
Baker Thermal Oxidizer - Temporary System	250	0.003	0.006	0.001	0.003	0.47	lb/hr
		0.012	0.025	0.004	0.015	2.07	ton/yr
Thermal Accelerator - Phase I	400	0.004	0.009	0.001	0.006	0.76	lb/hr
		0.019	0.040	0.007	0.024	3.31	ton/yr
Thermal Oxidizer - Phase I	250	0.003	0.006	0.001	0.003	0.47	lb/hr
		0.012	0.025	0.004	0.015	2.07	ton/yr
Thermal Oxidizer - Phase II	400	0.004	0.009	0.001	0.006	0.76	lb/hr
		0.019	0.040	0.007	0.024	3.31	ton/yr

These emission rates assume that each system component is operated for a full year, which is a conservative estimate as the temporary system will only operate for two to four months and the Phase I operations will occur for six months to twelve months. Phase II operations will occur for a total of twelve to twenty-four months after Phase I.

The first year of the project incorporates emissions from the temporary system and Phase I operations of the thermal accelerator and thermal oxidizer. Therefore the total calculated emissions of all constituents in the first year are 7.65 tons/year. The calculated emission rates for years two and three are for Phase II only. The calculated emission rates for each project year are given in Table 4.

Table 4. Emission rate by project year

Project Year	Benzene	Toluene	Ethylbenzene	Total Xylenes	TPH (GRO)	Total	Units
Year One	0.010	0.021	0.003	0.013	1.70	1.75	lb/hr
	0.042	0.090	0.015	0.055	7.45	7.65	ton/yr
Year Two	0.004	0.009	0.001	0.006	0.76	0.78	lb/hr
	0.019	0.040	0.007	0.024	3.31	3.40	ton/yr
Year Three	0.004	0.009	0.001	0.006	0.76	0.78	lb/hr
	0.019	0.040	0.007	0.024	3.31	3.40	ton/yr

These calculations assume that the concentration of contaminant remains constant over the life of the project. Studies[3] and DBS&A experience indicate that soil vapor concentrations decrease exponentially over time, so that the emission rates presented above are a highly conservative estimate of the total potential emission rate, especially for years two and three.

NMED AQB guidance[4] indicates that to qualify for a no permit required (NPR) designation the combined emissions from a facility must be less than 10 pounds per hour and 10 tons per year of any regulated air contaminant. This project meets the specifications in that neither a single contaminant nor the sum of all the contaminants exceed the 10 pounds per hour or 10 tons per year limitation.

Table 1. Summary of Soil Vapor Analytical Organic Chemistry Data
Santa Fe Judicial Complex, Santa Fe, New Mexico

Sampling Point	Date Sampled	Concentration[a] (µg/L)						
		Benzene	Toluene	Ethyl-benzene	Total Xylenes	BTEX	MTBE	TPH (GRO)
SVE-9 @ 0915	11/07/09	3,100	4,800	450	1,600	9,950	<63	340,000
SVE-9 @ 1215	11/07/09	1,700	3,100	380	1,600	6,780	<130	240,000
SVE-9 @ 1430	11/07/09	2,300	4,400	470	1,700	8,870	<130	330,000
SVE-5 @ 0845	11/08/09	160	400	120	470	1,150	<130	36,000
SVE-5 @ 1145	11/08/09	72	230	67	270	639	<130	19,000
SVE-5 @ 1400	11/08/09	59	190	56	230	535	<130	16,000

[a] Analyzed in accordance with U.S. Environmental Protection Agency (EPA) methods 8021B for VOCs and 8015B for TPH (GRO).

µg/L = Micrograms per liter
BTEX = Benzene, toluene, ethylbenzene, and total xylenes
MTBE = Methyl tertiary-butyl ether
TPH = Total petroleum hydrocarbons
GRO = Gasoline range organics

Table 1. Summary of Analytical Organic Chemistry Data for Soil Vapor Montezuma Remediation, Santa Fe, New Mexico

Sampling Point	Date Sampled	Concentration[a] (µg/L)						
		Benzene	Toluene	Ethyl-benzene	Total Xylenes	BTEX	MTBE	TPH (GRO)
SVE-3 @ 0900	12/19/2009	110	280	52	180	622	<25	31,000
SVE-3 @ 1130	12/19/2009	150	390	63	180	783	<130	39,000
SVE-3 @ 1400	12/19/2009	180	560	80	290	1,110	<63	46,000

[a] Analyzed in accordance with U.S. Environmental Protection Agency (EPA) methods 8021B for VOCs and 8015B for TPH (GRO).

µg/L = Micrograms per liter
BTEX = Benzene, toluene, ethylbenzene, and total xylenes
MTBE = Methyl tertiary-butyl ether
TPH = Total petroleum hydrocarbons
GRO = Gasoline range organics

B1

AcuVac Remediation Inc.

1656-H Townhurst, Houston, Texas 77043
713.468.6688 · fax:713.468.6689 · www.acuvac.com

November 14, 2009

Mr. Gundar Peterson, P.E.
Daniel B. Stephens & Associates
6020 Academy Rd. N.E., Suite 100
Albuquerque, NM 87109

Dear Gundar:

Re: Montezuma Remediation, 210-218 Montezuma Ave., Santa Fe, NM
Project # E509.0215

Following is the report on **Soil Vacuum Extraction (SVE) Pilot Testing** performed on November 7 & 8, 2009, at the above referenced location. Two tests were conducted using AcuVac's SVE I-6 System, with Roots RAI-33 blower, various instrumentation, including the HORIBA Analyzer, Lumidor O_2 and LEL Analyzer, MMC and Solinst Interface Probes, magnehelic gauges, Dwyer digital manometer, flow gauges, a sensitive instrument to determine barometric pressure and absolute pressure, V-1 Vacuum Box to capture non-diluted vapor samples and other special equipment. The test consisted of two extended tests. An Engineer and Geologist with over 14,000 hours of on-site testing conducted the Pilot Tests. The total test time including static data time was 16 hours.

Introduction

The vacuum extraction portion of the AcuVac SVE System consists of a vacuum pump driven by an internal combustion (IC) engine. The vacuum pump is connected to the extraction well and the vacuum created on the extraction well causes hydrocarbons in the soil to volatilize and flow through a moisture knockout tank to the vacuum pump and the internal combustion engine where they are burned as part of the normal combustion process. Propane is used as an auxiliary fuel to help power the engine if the well vapors do not provide the required BTU.

Emissions from the engine are passed through three catalytic converters to ensure maximum destruction of removed hydrocarbon vapors. The engine's fuel to air ratio can be adjusted to maintain efficient combustion. Because the engine is the power source for all equipment, all systems stop when the engine stops. This eliminates any uncontrolled release of hydrocarbons. Since the System is held entirely under vacuum, any leaks in the seals or connections are leaked into the System and not emitted into the atmosphere. The engine is automatically shut down by vacuum loss, low oil pressure or overheating.

SCHEDULE A

MONTEZUMA REMEDIATION
SANTA FE, NM
Test #SVE-1, Pg 3

AcuVac Remediation Inc.

11/7/09	Thirteenth Data Time 1400	Fourteenth Data Time 1430	Fifteenth Data Time 1500	Sixteenth Data Time 1530	Static Data Time 1600	Average Data 7.5 Hrs	Maximum Data
Horiba HC ppm	NA	87,190	NA	83,190	NA	81,811	87,190
Horiba CO_2%	NA	3.00	NA	3.28	NA	3.32	6.35
Horiba CO%	NA	6.80	NA	5.60	NA	5.21	6.80
Horiba O_2%	NA	10.9	NA	12.9	NA	11.6	13.5
LEL	NA	225	NA	203	NA	206	225
Influent Vapor Temp °F	68	68	68	68	NA	68	68
Barometric Pressure "Hg	30.20	30.20	30.20	30.18	30.18	30.25	30.28
Extraction Well Flow SCFM Well SVE-9	3.92	5.30	5.30	5.30	OFF	4.81	5.30
Extraction Well Vacuum "H_2O Well SVE-9	60.0	90.0	90.0	90.0	OFF	72.2	90.0
Well MW-11 Vacuum "H_2O Dist. 15.0 ft	30.30	31.92	32.00	32.75	10.66	28.47	32.75
Well MW-12 Vacuum "H_2O Dist. 23.0 ft	5.54	5.74	5.80	5.93	1.87	5.26	5.98
Well SCF-MW-11 Vacuum "H_2O Dist. 42.0 ft	1.99	2.08	2.12	2.16	1.28	1.85	2.16
Well SCF-MW-7 Vacuum "H_2O Dist. 52.0 ft	.52	.53	.54	.55	.19	.51	.63
Well SCF-MW-12 Vacuum "H_2O Dist. 53.0 ft	-(.69)	-(.74)	-(.67)	-(.62)	-(.58)	-(.31)	.42
Groundwater Upwelling - ft	4.368	5.379	5.647	6.035	.173	4.783	6.395

-() Indicates Well Pressure

NA - No Data Recorded

11/8/09	Fourteenth Data Time 1400	Fifteenth Data Time 1430	Sixteenth Data Time 1500	Static Data Time 1530	Average Data 7.5 Hrs	Maximum Data
Horiba HC ppm	NA	3,060	NA	NA	6,128	13,240
Horiba CO_2%	NA	5.72	NA	NA	5.99	7.46
Horiba CO%	NA	0	NA	NA	0.01	0.03
Horiba O_2%	NA	15.2	NA	NA	13.3	16.8
LEL	NA	18	NA	NA	32	55
Influent Vapor Temp °F	63	63	63	NA	63	63
Barometric Pressure "Hg	30.19	30.18	30.18	30.19	30.21	30.25
Extraction Well Flow SCFM Well SVE-5	51.04	58.32	60.38	OFF	34.01	60.38
Extraction Well Vacuum "H_2O Well SVE-5	30.0	35.0	35.0	OFF	24.4	35.0
Well MW-6 Vacuum "H_2O Dist. 22.0 ft	.49	.58	.57	-(.01)	.37	.57
Well MW-5 Vacuum "H_2O Dist. 30 0 ft	.42	.52	.50	-(.01)	.35	.52
Well CMW-5 Vacuum "H_2O Dist. 57.0 ft	-(1.74)	-(1.61)	-(1.46)	-(.46)	-(2.29)	-(.22)
Well SVE-1 Vacuum "H_2O Dist. 59.0 ft	10	13	14	-(.01)	.08	14
Well CMW-4 Vacuum "H_2O Dist. 65.0 ft	.06	.09	10	0	.05	10
Well MW 7 Vacuum "H_2O Dist. 81.0 ft	.06	.05	.05	0	.04	.07
Well SVE-4 Vacuum "H_2O Dist. 101.0 ft	.03	.03	.06	-(.01)	.03	.06
Well SVE-2 Vacuum "H_2O Dist. 104.0 ft	.02	.02	.03	-(.01)	.02	.03
Well CMW-6 Vacuum "H_2O Dist. 115.0 ft	.03	.05	.03	-(.01)	.03	.05
Groundwater Upwelling ft	1.361	1.550	1.665	-	1.014	1.665

( ) Indicates Well Pressure

NA No Data Recorded

B2

AcuVac Remediation Inc.

1656-H Townhurst, Houston, Texas 77043
713.468.6688 · fax:713.468.6689 · www.acuvac.com

December 28, 2009

Mr. Gundar Peterson, P.E.
Daniel B. Stephens & Associates
6020 Academy Rd. N.E., Suite 100
Albuquerque, NM 87109

Dear Gundar:

Re: Montesuma Remediation, 210-218 Montezuma Ave., Santa Fe, NM
Project # E509.0215

Following is the report on **Soil Vacuum Extraction (SVE) Pilot Testing** performed on December 18 & 19, 2009, at the above referenced location. The test was conducted using AcuVac's SVE I-6 System, with Roots RAI-33, various instrumentation, including the HORIBA Analyzer, Lumidor O_2 and LEL Analyzer, MMC and Solinst Interface Probes, In-Situ data logger, magnehelic gauges, Dwyer digital manometer, flow gauges, a sensitive instrument to determine barometric pressure, V-1 Vacuum Box to capture non-diluted vapor samples and other special equipment. The test consisted of one extended test and seven SVE Quick Tests. An Engineer and Geologist with over 14,000 hours of on-site testing conducted the Pilot Tests. The total test time including static data SVE Quick Tests was 11.0 hours.

Introduction

The vacuum extraction portion of the AcuVac SVE System consists of a vacuum pump driven by an internal combustion (IC) engine. The vacuum pump is connected to the extraction well and the vacuum created on the extraction well causes hydrocarbons in the soil to volatilize and flow through a moisture knockout tank to the vacuum pump and the internal combustion engine where they are burned as part of the normal combustion process. Propane is used as an auxiliary fuel to help power the engine if the well vapors do not provide the required BTU.

Emissions from the engine are passed through three catalytic converters to ensure maximum destruction of removed hydrocarbon vapors. The engine's fuel to air ratio can be adjusted to maintain efficient combustion. Because the engine is the power source for all equipment, all systems stop when the engine stops. This eliminates any uncontrolled release of hydrocarbons. Since the System is held entirely under vacuum, any leaks in the seals or connections are leaked into the System and not emitted into the atmosphere. The engine is automatically shut down by vacuum loss, low oil pressure or overheating.

12/19/09	Thirteenth Data Time 1400	Fourteenth Data Time 1430	Fifteenth Data Time 1500	Static Data Time 1530	Average Data 7.0 Hrs	Maximum Data
Horiba HC ppm	NA	17,190	NA	NA	23,774	31,860
Horiba CO_2%	NA	1.30	NA	NA	1.65	1.84
Horiba CO%	NA	0	NA	NA	0.16	0.38
Horiba O_2%	NA	18.4	NA	NA	18.1	18.4
LEL	NA	87	NA	NA	110	-
Influent Vapor Temp °F	56	56	56	NA	56	56
Barometric Pressure "Hg	30.29	30.30	30.30	30.30	30.33	30.36
Extraction Well Flow SCFM Well SVE-3	41.30	41.30	41.30	OFF	29.18	41.30
Extraction Well Vacuum "H_2O Well SVE-3	60.0	60.0	60.0	OFF	38.0	60.0
Well SCF-MW-10 Vacuum "H_2O Dist. 36.0 ft	.53	.55	.56	-	.36	.56
Well SVE-2 Vacuum "H_2O Dist. 43.0 ft	.15	.16	.16	0	.11	.16
Well SVE-1 Vacuum "H_2O Dist. 45.0 ft	.14	.15	.15	0	.10	.15
Well MW-6 Vacuum "H_2O Dist. 52.0 ft	.20	.21	.22	0	.12	.22
Well SVE-5 Vacuum "H_2O Dist. 64.0 ft	.06	.06	.09	-	.06	.09
Well MW-2 Vacuum "H_2O Dist. 118.0 ft	.02	.03	.02	-	.02	.03
Groundwater Upwelling - ft	5.143	5.172	5.163	-	3.293	5.172

-() Indicates Well Pressure

NA - No Data Recorded

1a

INTELLISHARE ENVIRONMENTAL

CLEAN AIR SOLUTIONS

E4803 395th Avenue
Menomonie, WI 54751 USA
Phone: 715-233-6115
Fax: 715-232-0669
E-Mail: jstrey@intellishare-env.com
Website: www.intellishare-env.com

Date: 12/18/09

ISE Proposal No: N-09-0934R2
Client Project ID: Sante Fe New Mexico

Proposal For: Tom Golden
DB Stephens

Phone: 505-353-9075
Fax:
Email: tgolden@dbstephens.com

Proposed Solution: 500 CFM High BTU Thermal Accelerator

Thank you for the opportunity to provide the following proposal for your project. At Intellishare Environmental, every client is important. Please contact me with any questions you may have regarding this information.

Kind Regards,

INTELLISHARE ENVIRONMENTAL, INC.

John Strey
Principal

1a

Thermal Accelerator Process Information

▪ Air Flow From SVE:	500 SCFM
▪ Maximum VOC Input:	+50,000 ppmv
▪ Minimum Air Flow:	250 SCFM
▪ Maximum Pressure Drop to SVE:	30" w.c.
▪ Min Gas Pre-Heater Operating Input:	150,000 BTUH
▪ Max Gas Pre-Heater Input:	1.8 MM BTUH
▪ Minimum Thermal Operating Temperature:	1400 degrees F.
▪ Average Thermal Operating Temperature:	1400-1700 degrees F.
▪ Maximum Thermal Operating Temperature:	1800 degrees F.
▪ Minimum Catalyst Inlet Temperature:	600 degrees F.
▪ Average Catalyst Operating Temperature:	650 degrees F.
▪ Maximum Catalyst Operating Temperature:	1200 degrees F.
▪ Catalyst Volume:	1.4 cubic feet
▪ Catalyst Gas Hourly Space Velocity:	39,000 $GHSV^{-1}$
▪ Catalyst Destruction Efficiency:	> 99% (all modes)
▪ Est Time to Reach Operating Temperature:	15 minutes from cold start
▪ Total Fan Horsepower:	12.5 hp
▪ Max Amperage Requirement @ 230/3/60:	40
▪ Noise Level:	< 80 dBA at a distance of 10'
▪ Size:	W=94", L=16', H=106"
▪ Overall Stack Height:	17' AGL
▪ Weight:	7,500 lbs

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INTELLISHARE ENVIRONMENTAL

CLEAN AIR SOLUTIONS

E4803 395th Avenue
Menomonie, WI 54751 USA
Phone: 715-233-6115
Fax: 715-232-0669
E-Mail: jstrey@intellishare-env.com
Website: www.intellishare-env.com

Date: 12/18/09

ISE Proposal No: N-09-0958
Client Project ID: Sante Fe New Mexico

Proposal For: Tom Golden
DB Stephens

Phone: 503-353-9075
Fax:
E-Mail: tgolden@dbstephens.com

Application: Remediation

Proposed Solution: 500 CFM SVE/Thermal Oxidizer

Intellishare Environmental specializes in the engineering and manufacturing of clean air solutions for the environmental remediation industry. We offer new, used, rental and lease programs to fit any budget or application.

Thank you for the opportunity to provide the following proposal for your project. At Intellishare Environmental, every client is important. Please contact me with any additional questions you may have regarding this information.

Kind Regards,

John Strey
Principal

16

SVE/Oxidizer Process Information

▪ SVE Inlet Design Air Flow Capacity:	400 SCFM
▪ Design Vacuum:	75" W.C.
▪ Max Gas Pre-Heater Input:	1,500,000 BTUH
▪ Minimum Thermal Operating Temperature:	1400 degrees F.
▪ Maximum Thermal Operating Temperature:	1600 degrees F.
▪ Minimum Catalyst Inlet Temperature:	550 degrees F.
▪ Average Catalyst Operating Temperature:	600 degrees F.
▪ Maximum Catalyst Operating Temperature:	1200 degrees F.
▪ Catalyst Volume:	.764 cubic feet
▪ Catalyst Gas Hourly Space Velocity:	39,000 $GHSV^{-1}$
▪ Destruction Efficiency:	➢ 99% (thermal) ➢ 98% (catalytic)
▪ Maximum LEL Throughput:	25% without LEL Sensor 50% with LEL Sensor
▪ Time to Reach Operating Temperature:	15-20 minutes from cold start
▪ Inlet Connection:	6" Flange
▪ Stack Height:	To Be Determined
▪ Foot Print:	W=8', L=12', H=8'
▪ Weight:	7000 lbs

(2)

QUOTATION #6794

October 21, 2008

Mr. Peter Guerra
AMEC Earth & Environmental, Inc. (505) 821-1801
8519 Jefferson NE
Albuquerque, NM 87113
Re: 300 CFM Thermal Oxidizer

300-CFM Thermal/Catalytic Oxidizer General Specifications

Baker Furnace, Inc. is pleased to present this proposal to **AMEC Earth & Environmental, Inc.** for a Gas Fired 300-CFM Thermal/Catalytic Oxidizer System. This Oxidizer would be constructed as a "turnkey" system ready for operation and would have all the necessary instrumentation and controls to meet applicable Air Quality Standards. We are sure you will find our quality, value and services exceptional!

One (1) **Gas Fired Thermal/Catalytic Oxidizer** rated at **300 SCFM @ 60" H_2O vacuum (100" H_2O maximum vacuum)**. Trailer Mounted System includes a Knock-Out Tank/Entrainment Separator with High Water Level Switch, Site Glass and In-Line Filter, LEL Auto-Dilution Valving based on temperature, Roots 56 URAI P-D Vacuum Blower with 10 hp TEFC 3 Phase Motor, FM Approved Flame Arrester, Air Pressure Switch, Pitot Tube with Pressure Transmitter, Carbon Steel Shell Insulated with High Temperature Insulation with Catalyst "Ready" Design, U.L Classified Nema 4 Control Panel, Eclipse Package Burner with integrated combustion blower, Fully Modulating FM Fuel Train, and misc. Wiring and Piping. Note-Catalytic Cell is offered as an option.

300 CFM Thermal/Catalytic Oxidizer Technical Specifications

Parameter	Thermal Mode	Catalytic Mode
Destruction Efficiency	99%+	98%+
Operating Temperature	1450 Degrees F	750 Degrees F
Supplemental Fuel	Propane or Natural Gas	Propane or Natural Gas
Fuel usage at 0% LEL w/ Heat Exch.	400,000 BTU/hr.	175,000 BTU/hr.
Maximum Concentration to Oxidizer	50% of LEL	25% of LEL
Vacuum available	100" H_2O	100" H_2O
Stack Height (Discharge height)	Min. 13.5 feet	Min. 13.5 feet
Exit Velocity	600 feet/min	450 feet/min.
Chart Recorder Measurements	Temperature & Flow	Temp In, Temp Out & Flow
Overall Dimensional Footprint	8.5' wide x 14' long	8.5' wide x 14' long
Approximate Shipping Weight	5,600 lbs.	5,600 lbs.
Inlet Pipe size for VES.	3" N.P.T.	3" N.P.T
Inlet pipe size for Natural Gas/ Propane	1" N.P.T.	1" N.P.T.
Inlet Gas pressure required	5 PSI	5 PSI
Fuel Supply Requirement (Start Up)	750,000 Btu/hr. –800 ft^3/Hr.	350,000 Btu/hr. –400 ft^3/Hr.
Horsepower, VES Blower	10 H.P. @ 100" H_2O	10 H.P. @ 100" H_2O
Electrical Service	230 VAC, 3Ø, 60 Amps	230 VAC, 3Ø, 60 Amps
Residence Time for Vapors Oxidized	1-second residence time.	N/A

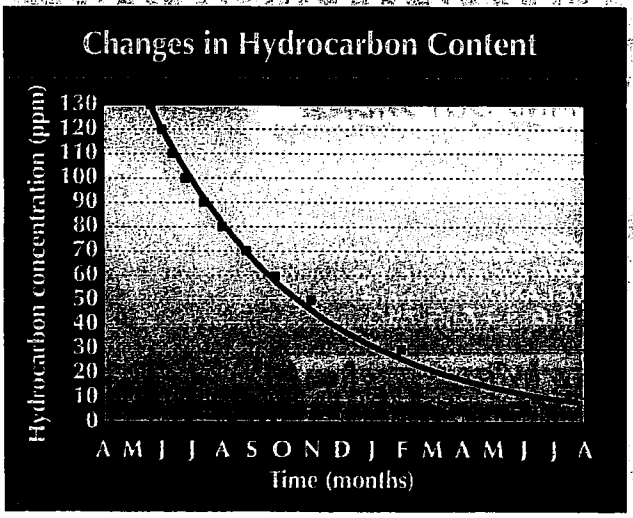
Selecting the Appropriate Abatement Technology

Estimating the life-cycle costs of treating hydrocarbon vapors extracted from soil.

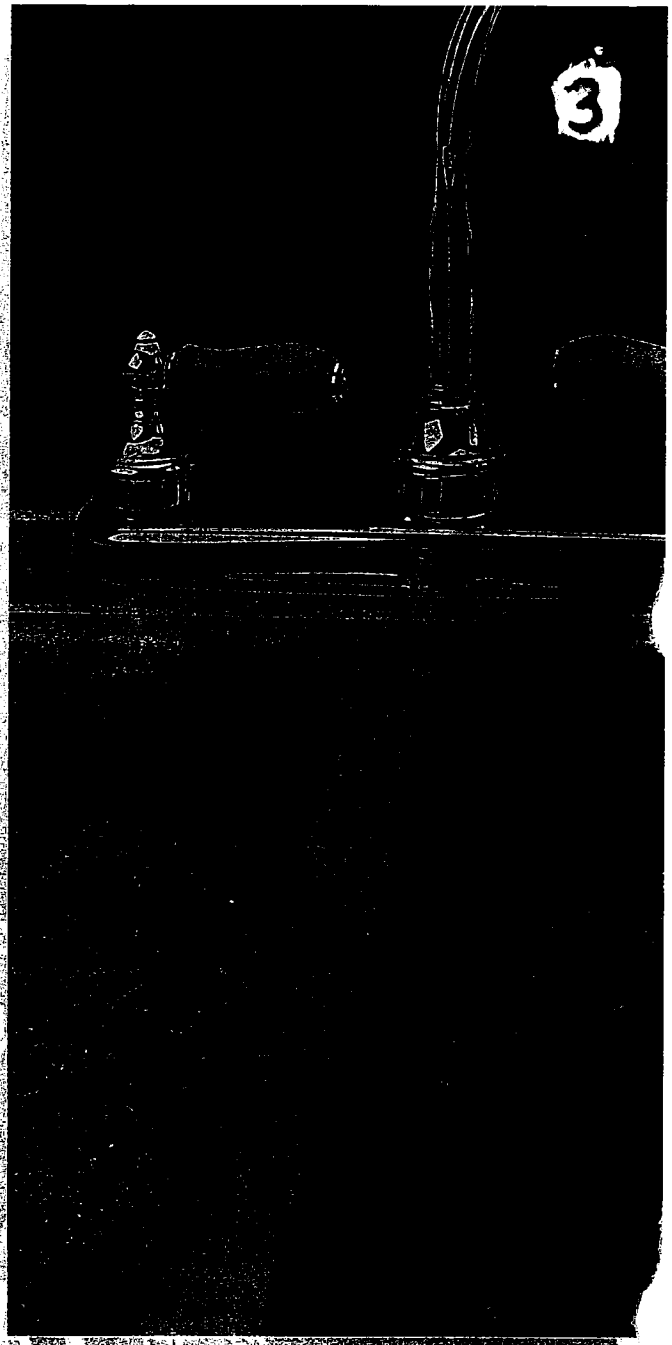
by Dr. Peter M. Kroopnick

Vapor extraction systems commonly are used to remediate soil contaminated with volatile and semivolatile hydrocarbons. The source of this contamination usually is a leak from an underground storage tank (UST), although accidental spills from pipelines and aboveground tanks also are common. The typical vapor extraction system consists of a vacuum pump attached to shallow extraction wells completed in the vadose zone. The rate of extraction depends on the diffusion and advection of vapor from the contaminated zone, and on the bulk permeability of the soil.

Control of emissions from soil-vent systems increasingly is required. In these cases, the factor that limits the rate of hydrocarbon extraction very often is not the rate of extraction from the ground, but rather the capacity of the abatement device. The concentration of hydrocarbon in the extracted vapor usually is high at the beginning of a remediation and displays an exponential decrease over time (Kroopnick, 1995). There are various strategies for selecting the technology and capacity for the treatment system based on life-cycle costing principles. The devices discussed are vapor-phase granular activated carbon, catalytic oxidation with and without a heat recovery system and thermal oxidation.



• *Figure 1. Changes in hydrocarbon content of a vapor-stream during a soil-vent cleanup (squares). The solid line represents an exponential decay with a removal factor of 0.38 per day.*



Vapor removal from the vadose zone

A soil-vent feasibility study often is performed to determine the site-specific parameters necessary to design a successful and efficient soil-vent system. The key parameters that must be determined are the location of the contaminant, the permeability of the various soil layers and the ability to induce air flow preferentially through the contaminated area. It also is important to ascertain the actual hydrocarbon concentra-

A mathematical model simulates the cost of treating extracted volatiles.

Buscheck and Peargin (1991) conducted a survey of 143 operating vapor extraction systems and found two distinct decay patterns. The first conforms to the exponential model, while the second exhibits a decay with a non-zero asymptote for the mass removal. This latter pattern usually occurs in non-homogeneous formations where slow diffusion from the less permeable zone limits the rate of cleanup (Tormey et al., 1992).

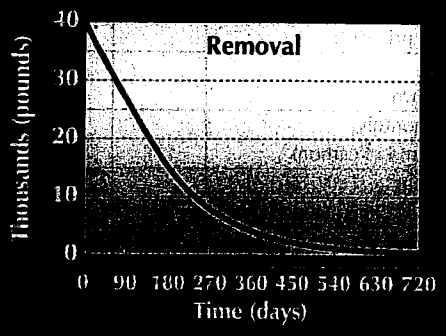
Simulating a remediation

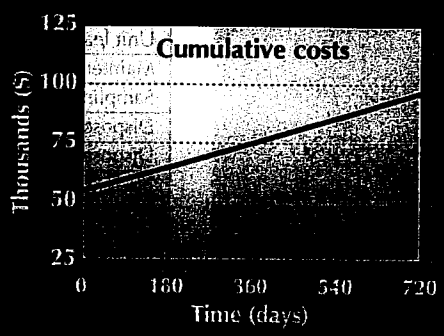
In most cases, the hydrocarbon concentration decreases very rapidly at startup and is followed by an asymptotic approach to zero. To estimate the life-cycle costs for operating an abatement device, this exponential change with time first must be simulated for each site. Exact mathematical models have been proposed for these systems (Johnson et al., 1988). However, because the field data needed to run an exact model usually are not obtainable, we have taken an empirical approach for the purpose of developing a cost analysis methodology.

The model chosen for this simulation is a first order decay process in which the amount of material removed at each time step is calculated based on the assumption that the total remaining mass and the vapor phase concentration approach zero simultaneously. The simulation is performed on a personal computer using a spreadsheet or with an in-house program called the Vapor Abatement Cost Analysis Program (VACAP) (Kroopnick, 1995). Site-specific data must be obtained for the initial concentration of hydrocarbon in the extractable vapor and for the total amount of contamination to be treated. For each abatement device, information is required for the rate of flow through the device, and for the maximum hydrocarbon concentration the device safely can process.

A critical part of the simulator is the removal rate factor (RF), equivalent to the exponential decay factor in the equation. In the models shown, the RF is adjusted to force both the mass of hydrocarbon remaining and the current concentration to simultaneously approach zero. Figure 2 shows a simulation for a catalytic oxidizer with a heat exchanger. For each time step, the hydrocarbon concentration in the vapor phase is decreased using the equation. If the current concentration is greater than the abatement unit can handle, it must be diluted to an acceptable level. In that case, the effective flow from the soil is reduced as shown in the daily flow column of Figure 2. This dilution usually is accomplished by opening a bleed

Results for VACAP Analysis of a Catalytic Oxicizer with a Heat Exchanger





Time (days)	Contaminant left (pounds)	Daily flow (cfm)	Daily cost ($)		
0	40,000	0.0	0	10,000	49
30	35,652	144.9	96	8090	52
60	31,303	144.9	118	6545	52
90	26,955	144.9	146	5295	52
120	22,607	144.9	181	4284	52
150	18,388	129.7	200	3466	54
180	14,894	104.9	200	2804	58
210	12,066	84.9	200	2268	61
240	9779	68.7	200	1835	63
270	7929	55.6	200	1485	65
300	6432	45.0	200	1201	67
330	5220	36.4	200	972	68
360	4241	29.4	200	786	69
390	3448	23.8	200	636	70
420	2806	19.3	200	515	71
450	2288	15.6	200	416	72
480	1868	12.6	200	337	72
510	1528	10.2	200	272	72
540	1253	8.3	200	220	73
570	1031	6.7	200	178	73
600	851	5.4	200	144	73
630	706	4.4	200	117	73
660	588	3.5	200	94	73
690	493	2.9	200	76	74
720	416	2.3	200	62	74

54,950	54,950
56,485	56,488
58,020	58,027
59,556	59,565
61,150	61,102
62,695	62,537
64,379	64,140
66,063	65,828
68,019	67,581
69,951	69,383
71,939	71,221
73,971	73,085
76,039	74,966
78,136	78,858
80,256	78,756
82,396	80,654
84,551	82,551
86,718	84,444
88,895	86,329
91,081	88,206
93,273	90,073
95,470	91,930
97,672	93,775
99,877	95,607
102,085	97,427

• ***Figure 2. Results for the VACAP analysis of a catalytic oxidizer with a heat exchanger.***

(4)

Overview & Guidance to New Mexico NSR Air Permitting Requirements

This document will help you determine if your facility is required to obtain a pre-construction New Source Review (NSR) Air Quality permit. The Air Quality Bureau categorizes facilities into three major groups when determining if an Air Quality permit is required:

- No Permit Required (NPR) determination – A facility may submit emissions calculations and supporting documentation requesting an NPR determination if it believes it does not require a permit or an NOI. To be eligible for an NPR determination, a facility's potential emission rate (PER) must be less than 10 pounds per hour (pph) and 10 tons per year (tpy) of any regulated air contaminant or 1 ton per year (tpy) of lead.

- Notice of Intent to construct (NOI) – A NOI is not a permit, but is required for facilities that have a PER of less than 10 pounds per hour (pph), but more than 10 tons per year (tpy) of any regulated air contaminant. Refer to 20.2.73.200 NMAC for applicability.

- Permit – A permit is required for facilities that have a PER, not potential to emit (PTE) that is greater than 10 pph and 25 tpy. Refer to 20.2.72.200 NMAC for applicability. A permit can contain conditions that limit a facility's PTE to something less than its PER. The submittal of a 20.2.72 NMAC permit application also fulfills the 20.2.73 NOI application submittal requirements.

Both regulations cited above can be found at http://www.nmenv.state.nm.us/aqb/regs/index.html. The applicability section of both regulations should be read carefully. The applicability determinations of these regulations is based on PER (not PTE); the PER of the facility is the worst-case emission rate of the facility without controls or other limitations (unless the controls or limitations are federally enforceable) and as if the facility were operating continuously 8760 hours per year (24 hrs/day, 365 days/yr). 20.2.72.202 lists processes that are exempt from permitting.

If you determine your facility needs a permit, you will need to read all of 20.2.72 NMAC. At this point many companies hire a consultant. We can provide a list of consultants who process New Mexico applications. Please understand that it is not proper for us to recommend any particular consultant.

If you are a small business, you may want to call our small business assistance hotline, 505-222-9507 or 800-224-7009. Our Small Business Assistance staff will be happy to assist you. A definition of a "small business" can be found at http://www.nmenv.state.nm.us/aqb/sbap/index.html.

For other than New Source Review (NSR) permitting Air Quality questions refer to our Air Quality Bureau contacts page at http://www.nmenv.state.nm.us/aqb/AQB-Contacts.html. I hope this information is of some assistance.

Ted Schooley

NSR Section Manager
Air Quality Bureau
2048 Galisteo
Santa Fe, New Mexico 87505
ted.schooley@state.nm.us
Telephone: (505) 827-1494
Fax: (505) 827-1523

Section 7

Information Used To Determine Emissions

Information Used to Determine Emissions shall include the following:

- ☐ If manufacturer data are used, include specifications for emissions units and control equipment, including control efficiencies specifications and sufficient engineering data for verification of control equipment operation, including design drawings, test reports, and design parameters that affect normal operation.
- **X** If test data are used, include a copy of the complete test report. If the test data are for an emissions unit other than the one being permitted, the emission units must be identical. Test data may not be used if any difference in operating conditions of the unit being permitted and the unit represented in the test report significantly effect emission rates.
- ☐ If the most current copy of AP-42 is used, reference the section and date located at the bottom of the page. Include a copy of the page containing the emissions factors, and clearly mark the factors used in the calculations.
- ☐ If an older version of AP-42 is used, include a complete copy of the section.
- ☐ If an EPA document or other material is referenced, include a complete copy.
- ☐ Fuel specifications sheet.
- ☐ If computer models are used to estimate emissions, include an input summary (if available) and a detailed report, and a disk containing the input file(s) used to run the model. For tank-flashing emissions, include a discussion of the method used to estimate tank-flashing emissions, relative thresholds (i.e., permit or major source (NSPS, PSD or Title V)), accuracy of the model, the input and output from simulation models and software, all calculations, documentation of any assumptions used, descriptions of sampling methods and conditions, copies of any lab sample analysis.

Please see attached SVE Pilot Test Report and laboratory report on the following pages.

AcuVac Remediation Inc.

1656-H Townhurst, Houston, Texas 77043
713.468.6688 · fax:713.468.6689 · www.acuvac.com

December 28, 2009

Mr. Gundar Peterson, P.E.
Daniel B. Stephens & Associates
6020 Academy Rd. N.E., Suite 100
Albuquerque, NM 87109

Dear Gundar:

Re: Montesuma Remediation, 210-218 Montezuma Ave., Santa Fe, NM
Project # E509.0215

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Emissions from the engine are passed through three catalytic converters to ensure maximum destruction of removed hydrocarbon vapors. The engine's fuel to air ratio can be adjusted to maintain efficient combustion. Because the engine is the power source for all equipment, all systems stop when the engine stops. This eliminates any uncontrolled release of hydrocarbons. Since the System is held entirely under vacuum, any leaks in the seals or connections are leaked into the System and not emitted into the atmosphere. The engine is automatically shut down by vacuum loss, low oil pressure or overheating.

The site is mostly located on Montezuma Street and paved parking areas which should provide an impermeable barrier to reduce SVE short-circuiting. However, due to the excavation, underground utilities and the location of two of the observation wells adjacent to an office building, some short-circuiting may have occurred.

SVE Test Objectives:

- Evaluate the potential for removing vapor phase LNAPL from the vadose zone.
- Provide data on the vapor phase concentrations in the influent vapors.
- Determine the SVE radius of influence to remove vapor phase LNAPL.

Project Scope:

- Open selected outer observation wells and install In-Situ data logger in extraction well (SVE-3) to record liquid level changes.
- Connect the AcuVac System to extraction well (EW) SVE-3, record the static well data, DTGW/DTLNAPL, well size, TD and screen intervals and then apply vacuum. Record the vacuum and well flow, all System data (including fuel flow of propane), temperature and barometric pressure.
- Set the SVE induced vacuum and well vapor flow at the selected range.
- The test procedures are to provide variable rates of vacuum and flow over the test period and record the data at a selected interval of time.
- Install and observe the magnehelic gauges or connect a digital manometer on the outer observation wells to determine if the selected EW is in vacuum communication with the outer observation wells. Record the data at a selected interval of time.
- Collect non-diluted influent vapor samples to provide on-site HORIBA Analyzer analytical data consisting of TPH up to 100,000 ppmv, CO_2%, CO% and O_2%.
- Record the vacuums/pressures on the outer monitoring wells.
- Record the distances from the selected EW to the outer wells.
- Conduct SVE Quick Tests (QTs) on selected monitoring/SVE wells. Gauge each well and provide DTGW and DTLNAPL. Start the SVE QTs, recording well vacuum and well flow, and provide HORIBA analytical data consisting of TPH, CO_2, CO and O_2.
- Operate the SVE System in such a manner that all well vapors are passed through the engine and catalytic converters to destruct the contaminants, and exhausted, meeting air emission standards. Comply with all safety regulations.
- Complete the tests by providing a report consisting of operating and analytical data, and projection of an SVE radius of influence.

Attached Schedules:

Attachment A: Acronyms and Definitions, Page 10
Schedule A: Summary of Data - 1 Extended Test #SVE-1
Schedule B: Graphic Summary of Data - Test #SVE-1
Figure #1: Plot of Observed Vacuum vs Distance at the Facility

Well Data Information:

TABLE #1 - TEST #SVE-3

WELL NO.		SVE-3	SFC-MW-10	SVE-2	SVE-1	MW-6	SVE-5	MW-6	EW/ GWUP [2]	EW/ VAC [3]
TD	ft	41.2	40.0	39.2	39.0	40.0	40.0	32.0	-	-
Screen	ft	16.2-41.2	25.0-40.0	14.2-39.2	14.0-39.0	25.0-40.0	15.0-40.0	12.0-32.0	-	-
Well size	in	4.0	4.0	4.0	4.0	2.0	4.0	2.0	-	-
DTGW - 0730 Hrs - Static	ft	29.94	30.30	28.65	29.76	30.44	31.52	28.31	-	-
DTGW - Hydro Equivalent	ft	28.93	28.74	28.65	29.71	30.43	30.49	28.31	-	-
DTLNAPL - 0730 Hrs - Static	ft	28.57	28.14	-	29.69	30.43	30.18	-	-	-
LNAPL - 0730 Hrs - Static	ft	1.37	2.11	-	0.07	.01	1.34	-	-	-
Data Logger - 0755 Hrs - Static	ft	7.954	28.74	28.65	29.71	30.43	30.49	28.31	0	0
Data Logger - 0800 Hrs - Start SVE	ft	8.412	-	-	-	-	-	-	0.458	15.0
Data Logger - 0830 Hrs	ft	9.208	-	-	-	-	-	-	1.254	15.0
Data Logger - 0900 Hrs	ft	9.712	-	-	-	-	-	-	1.758	15.0
Data Logger - 0930 Hrs	ft	10.014	-	-	-	-	-	-	2.060	20.0
Data Logger - 1000 Hrs	ft	10.008	-	-	-	-	-	-	2.054	20.0
Data Logger - 1030 Hrs	ft	11.112	-	-	-	-	-	-	3.158	35.0
Data Logger - 1100 Hrs	ft	11.118	-	-	-	-	-	-	3.164	35.0
Data Logger - 1130 Hrs	ft	11.127	-	-	-	-	-	-	3.173	35.0
Data Logger - 1200 Hrs	ft	12.124	-	-	-	-	-	-	4.170	50.0
Data Logger - 1230 Hrs	ft	12.204	-	-	-	-	-	-	4.250	50.0
Data Logger - 1300 Hrs	ft	12.196	-	-	-	-	-	-	4.242	50.0
Data Logger - 1330 Hrs	ft	12.125	-	-	-	-	-	-	4.171	50.0
Data Logger - 1400 Hrs	ft	13.097	-	-	-	-	-	-	5.143	60.0
Data Logger - 1430 Hrs	ft	13.126	-	-	-	-	-	-	5.172	60.0
Data Logger - 1500 Hrs - Stop SVE	ft	13.117	-	-	-	-	-	-	5.163	60.0
Data Logger - 1530 Hrs - Static	ft	-	-	-	-	-	-	-	0	0
DTGW - 1500 Hrs	ft	24.55	30.30	28.69	29.78	30.43	31.51	28.30	-	-
DTGW - Hydro Equivalent	ft	23.77	28.79	28.69	29.73	30.43	30.53	28.30	-	-
DTLNAPL - 1500 Hrs	ft	23.51	28.26	-	29.71	30.43	30.19	-	-	-
LNAPL - 1500 Hrs	ft	1.04	2.04	-	0.07	0.01	1.32	-	-	-
GW Level Decrease (+) / Increase (-) Based on Hydro Equivalent	ft	+3.49 [1]	-0.05	-0.04	-0.02	0	-0.04	+0.01	-	-
Distance from SVE-3	ft	0	36.0	43.0	45.0	52.0	64.0	118.0	-	-

1. Average GW/LNAPL upwelling/FT
2. GW/LNAPL upwelling during test period/FT
3. SVE Well Flow/scfm
4. SVE Induced Vacuum/"H_2O

Note: (a) Specific Gravity = 0.74

(b) The liquid upwelling is greater than the recorded data due to the difference in specific gravity of LNAPL and GW. The data logger is set for a specific gravity of 1.0.

Pre Test Functions

Prior to starting this test, all the SVE systems were checked for normal operation. The depth to groundwater (DTGW) and depth to light non-aqueous petroleum liquid (DTLNAPL) levels were recorded. Each magnehelic gauge was checked and calibrated to zero. The outer monitoring wells were plugged with expandable well plugs designed to accept magnehelic gauges and the digital manometer. Static well data was recorded prior to engaging the SVE System. The In-Situ data logger was installed in the EW and set at approximately 8.0 ft below static liquid level. The propane tank fuel level was recorded so that an accurate fuel consumption could be estimated for the total test period. The HORIBA Analyzer was set for the local altitude and calibrated with SPAN gas, which consists of Hexane and CO_2. All safety checks were performed on the System.

Discussion of Data: - Test SVE-3

Test #SVE-3 was a 7.5 hour SVE test, including the time for static well data, conducted from well SVE-3 as the vapor extraction well (EW). **The LNAPL thickness in EW was 1.37 ft.** Static well data indicated that the selected outer monitoring wells were recording slight vacuums ranging from 0.01 to 0.02"H_2O. The GW temperature was 61.97°F, the barometric pressure was steady at 30.34"Hg and the ambient air temperature was 31.3°F. **At the start of this 1.0 hour test period, the EW vacuum was 15"H_2O**, with a flow of 17.55 scfm and the influent vapor temperature was 56°F. All the outer wells, SFC-MW-10, SVE-1, 2 & 5 and MW-2 & 6, except MW-2 which is located 118 ft from the EW, recorded an increasing vacuum trend for 0.5 hours and then were steady to slightly variable during the next 0.5 hours. During this test period, the average recorded GW/LNAPL upwelling was 1.51 ft. The upwelling had a minimal effect on the available well screen.

The HORIBA Emission Analytical instrument is an accurate field instrument that will record TPH levels up to 100,000 ppmv and CO_2 levels up to 25%. During this initial test period, the HORIBA analytical data indicated the one influent vapor sample taken from the EW had hydrocarbon concentrations (HC) of 20,040 ppmv, with CO_2 at 1.64%, CO at 0.11% and O_2 levels of 18.2%. The propane flow was recorded at 60 cfh, with a well flow of 17.55 scfm. The influent vapors had a below average HC concentration with 1.37 ft of LNAPL in well SVE-3 and the saturated vadose zone. The gasoline contaminant may be somewhat weathered.

After 1.0 hour of steady induced vacuum, **the EW vacuum was increased 20"H_2O**, with a flow of 20.38 scfm. This test period was 1.0 hour. The outer wells within 50 ft of EW initially recorded an increasing vacuum trend in response to the increased induced vacuum and then remained mostly steady with slight increases and decreases. The barometric pressure increased from 30.34 to 30.36"Hg during this test period. The influent vapor temperature remained constant at 56°F and the ambient air temperature increased to 36.8°F. The average GW upwelling was 2.06 ft above static level.

Generally, a decreasing barometric pressure results in increased well pressures (decreased vacuums) on those wells plugged and sealed at the TOC, while an increasing barometric pressure results in increased well vacuums. **There are many variables that can affect Pilot Test data, but barometric pressure oscillations have the most immediate and profound effect.**

The purpose of a variable rate flow test is to define the pressure/flow characteristics of sub-surface soils around the EW and to estimate potential conditions for operational SVE Systems. Starting a test with lower variable rate vacuum and flow increases, allows the EW and outer wells sufficient time to adjust and stabilize, and minimizes the risk of developing preferential paths. This will also assist the development of newly installed vapor extraction wells.

HORIBA analytical data indicated the one influent vapor sample taken from the EW during this test period had HC levels of 19,760 ppmv, with CO_2 at 1.64%, CO at 0.10% and O_2 levels of 17.9% The propane flow was recorded at 60 cfh, with a well flow of 20.38 scfm. The influent vapors continued to record below average HC concentrations. CO_2 levels were in the low normal range and O_2 was in the mid to high range. The effluent (engine emissions) from an exhaust sample from the catalytic converters had an HC level of 168 ppmv and CO_2 at 4.62%.

After 1.0 hour of steady vacuum of 20"H_2O, **the induced vacuum was increased to 35"H_2O**, with a well flow of 25.97 scfm. The test period was 1.5 hours. The barometric pressure was on a decreasing trend at 30.33"Hg. The ambient air temperature increased to 38°F and the influent vapor temperature was steady at 56°F. All the outer wells, except MW-2, recorded an increasing vacuum trend in response to the EW vacuum increase and continued on a slight increasing trend for 1.0 hour. The GW upwelling averaged 3.16 ft above static level.

Additional HORIBA analytical data indicated the one influent vapor sample taken from the EW had an HC concentration of 26,850 ppmv, CO_2 at 1.70%, CO at 0.25% and O_2 levels of 18.0%. The propane flow was recorded at 30 cfh, with a well flow of 25.97 scfm.

After 1.5 hours of steady vacuum of 35"H_2O, **the induced vacuum was increased to 50"H_2O**, with a well flow of 35.61 scfm. The test period was 2.0 hours. The barometric pressure continued on a decreasing trend from 30.34 to 30.30"Hg. The ambient air temperature decreased to 37.7°F and the influent vapor temperature was steady at 56°F. All the outer wells, including MW-2, recorded an increasing vacuum trend in response to the EW vacuum increase for 1.0 hour and then became variable with slight increases and decreases. During the test period, the average recorded GW/LNAPL upwelling was 4.21 ft.

Additional HORIBA analytical data indicated the two influent vapor samples taken from the EW had HC concentrations of 31,860 and 27,650 ppmv, CO_2 at 1.84 and 1.76%, CO at 0.38 and 0.19% and O_2 levels of 17.6 and 18.1%. The propane flow was recorded at zero cfh, with a well flow of 35.61 scfm. **The well vapors were supplying 100% of the IC engine's required fuel.**

During the last 1.5 hours of the test, **the EW induced vacuum was increased to 60"H_2O**, with a well flow of 41.30 scfm. The outer wells immediately recorded an increased vacuum level for 1.0 hour and then remained mostly steady. The barometric pressure increased from 30.29 to 30.30"Hg. The ambient air temperature decreased to 37.2°F and the influent vapor temperature was steady at 56°F. The average recorded GW upwelling was 5.16 ft above static level. Before the induced vacuum was ceased, all the

outer wells were gauged. After the induced vacuum ceased, the static well data in wells SVE-1 & 2 and MW-6 were recorded 0.5 hours later. Each of these outer wells recorded zero"H_2O. During the 7.5 hour test period, the static LNAPL level in SVE-3 decreased from 1.37 to 1.04 ft.

HORIBA analytical data indicated the two influent vapor samples taken from the EW had HC concentrations of 23,070 and 17,190 ppmv, CO_2 at 1.70 and 1.30%, CO at 0.10 and 0% and O_2 levels of 18.3 and 18.4%. The lower HC levels may indicate the influent vapor samples were being diluted from an area within the ROI that had a lower HC concentration.

The test provided sufficient data for the calculation of a vacuum radius of influence for a specific zone. The beginning and final static well vacuums/pressures plus the barometric pressure oscillations during the test period had to be factored into the calculations.

SVE Quick Test Data

Tests #SVE-QTs were "Quick Tests" conducted from wells MW-5, 6 & 7 and SVE-1, 2, 3 & 4. A QT is defined as a short SVE test (approximately 0.25 to 0.5 hours) conducted from selected outer monitoring wells.

The following Table #2 indicates the recorded data during each QT. The test provides the vacuum, vapor well flow and HC, CO_2, CO and O_2 levels and can be used as background data to help in defining the parameters of the subsurface contamination into outer areas. The DTLNAPL and DTGW was recorded before each QT.

TABLE #2 - TEST #SVE-QT-1

Parameters: 12/18/09		Time 1230	Time 1300	Time 1330	Time 1400	Time 1430	Time 1500	Time 1615
Well No.		**SVE-2**	**SVE-3**	**SVE-1**	**MW-6**	**MW-5**	**MW-7**	**SVE-4**
HORIBA								
HC	ppmv	792	20,710	7,270	45,880	1,782	9,440	74
CO_2	%	1.14	1.12	5.14	8.66	9.54	10.12	2.00
CO	%	0	0.11	0.01	0.92	0	0	0
O_2	%	20.4	18.3	13.0	5.3	7.1	6.8	19.8
Gas Flow Fuel/Propane	cfh	100	30	90	40	100	70	110
Well Vacuum	"H_2O	20.0	35.0	15.0	40.0	40.0	40.0	40.0
Well Flow	scfm	20.48	22.15	24.52	15.31	7.66	15.31	24.08
Air Temperature	°F	34.2	34.4	35.4	43.2	42.1	38.9	37.1
Barometric Pressure	"Hg	30.26	30.26	30.25	30.24	30.24	30.22	30.30
DTLNAPL	ft	-	28.61	29.68	30.41	-	Trace	-
DTGW	ft	28.64	29.84	29.76	30.50	31.18	31.49	21.49

Fuel Use Information

The fuel required for the I-6 engine, at an average of 2,150 rpm and at the h.p. requirement of average test conditions at 7,000 ft altitude, is 3.05 gals/hr of propane. The measured (by volume) amount of propane used during the total SVE test time was 8.0 gallons, or 1.14 gals/hr. Therefore, the influent well vapors provided fuel equivalent to 1.91 gals/hr of propane or 62.6%. The well vapors may provide a higher percentage of fuel with increased well flow from additional vapor extraction wells located in areas with more contamination.

Emission Data

HORIBA data during the SVE test indicated the influent vapors had an average hydrocarbon level of 23,774 ppmv. Laboratory analysis of influent vapor samples has indicated that the trend for benzene level is approximately 2.0% of the TPH. Using an average well flow of 29.18 scfm, the calculated emissions from one extraction well are as follows:

HC	=	227	lbs/day	=	9.46	lbs/hr
Benzene	=	4.54	lbs/day	=	0.19	lbs/hr

These calculations are within 0.12 lb/hr compared to the Fuel Use Information above.

Although the HORIBA Analyzer has been reasonably accurate compared to laboratory analysis of influent vapors, projections should be based on analytical results from a Certified Testing Laboratory qualified to conduct tests on air emission samples.

Barometric and Absolute Pressure

The barometric pressure and change in barometric pressure during the SVE test period is read directly from **two** aircraft altimeters that have been tested and certified to 20,000 ft above sea level. The tests and certification were conducted by an FAA approved aircraft instrument company. During the SVE Pilot Test, the altimeters were set and held constant at an elevation of 6,980 ft. The corresponding barometric pressure is read directly from the altimeter.

The absolute pressure was calculated based on certified data obtained from the tests of the two altimeters. Between 0 ft (sea level) and 10,000 ft, the pressure differential per 1,000 ft is 36.570 mbar which equates to approximately 1.08"Hg. These two altimeters have actually been checked at each 1,000 ft interval and certified correct.

SCFM Calculations

To convert ACFM to SCFM, the following equation was used during the SVE Pilot Test:

$$SCFM = ACFM \sqrt{\frac{(14.7 \pm PSIG)}{14.7} \times \frac{520}{460 + {}^{\circ}FO}}$$

Where: $PSIG = \frac{"H_2O}{27.71}$

And: $^{\circ}FO$ = Observed temperature in $^{\circ}F$

Summary & Observations:

- **Test SVE-3:** Based on the recorded data for wells SVE-2 & 1 which are located adjacent to 210-218 Montezuma office building, SVE short-circuiting most likely occurred in this area. The average recorded vacuums on these wells were 0.11 to 0.10"H_2O and they are only located 7.0 and 9.0 ft farther from (EW) SVE-3 than SCF-MW-10 which had an average vacuum of 0.36"H_2O. Well MW-6, which is located 7.0 to 9.0 ft further from SVE-3 than SVE-2 & 1, recorded a higher average vacuum at 0.12"H_2O.
- An average induced vacuum of 38"H_2O was required to produce an average well flow of 29.18 scfm. The ratio of the vacuum to the well flow is 1.30:1. The average well flow per inch of H_2O vacuum is 0.77 scfm.
- When the EW induced vacuum was increased, each of the outer wells within 64 ft of EW recorded increased levels of vacuum.
- Due to the low induced vacuum in the EW, the GW average upwelling reduced the available well screen approximately 27%.
- The test provided sufficient data for the calculation and projection of a vacuum radius of influence, (ROI). **Figure #1 below, indicated the ROI from the recorded test data.**
- The SVE QTs indicated the areas with highest HC levels were well MW-6, extending to MW-7 and the SVE-3 area. The vapor well flow scfm indicated the soil is of medium permeability. The O_2 levels indicate the sub-surface is not O_2 deficient.
- **During the test period, the calculated amount of LNAPL consumed as IC engine fuel was 10.57 gals, or 66.5 lbs.**
- **SVE should be an effective method of remediation at this specific zone within the site.**

Additional Information (this should be read as part of the report):

- Field Operating Data and Notes
- Site Map
- Site Photographs

Conclusion:

Pilot Tests are conducted to provide information on short-term tests that can be projected into long-term remedial plans. These feasibility tests indicated that soil vacuum extraction should be an effective method of remediation for this facility. Although the observed vacuum on some of the outer observation wells was relatively low, the duration of the pilot tests was short compared to continuous operation. **However, the results give positive indication that wells SCF-MW-10, SVE-1, 2 & 5 and MW-6 were in vacuum communication with the selected SVE extraction well.** The radius of influence defines the region within which the vapor in the vadose zone flows to the extraction well under the influence of a vacuum. The radius of influence depends on soil properties of the vented zone, properties of surrounding soil layers, the depth at which the well is screened, well installation and the presence of any impermeable boundaries such as the water table, clay layers, surface seal, building basements and the presence of such areas as tank pits with backfill and underground utilities.

Radius of Influence:

Figure #1 indicates that the effective vacuum radius of influence from Test #SVE-3 would be from 37.00 to 41.47 ft, with extraction well flow of 35.0 to 37.0 scfm and extraction well vacuum in the 54 to 56"H_2O range. An approximation of the radius of influence may be obtained by determining the point at which the measured vacuum is **0.40 to 0.50"H_2O.** It is assumed that beyond the lower point, the pressure gradient (driving force) is negligible to effectively transport vaporized contaminants to the extraction well. Under continuous operation, vacuum and radius of influence will most likely continue to increase horizontally and vertically.

The effective radius of influence is based on calculations and equations using a software program of which data was provided from an extensive database collected by AcuVac over a period of years. Each projection is based on the test data and site parameters, and takes into consideration such variables as barometric pressure oscillations and gauge error. Although we cannot provide total assurance of accuracy, past experience and results have proven these projections to be well within the acceptable range of accuracy.

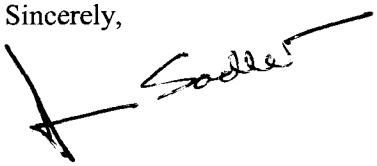
To calculate SVE and well placement, the equation we use is as follows:

$L = 2\ ROI\ Cos\ 30°$; L = distance between wells; ROI = radius of influence

All other data, including the groundwater depth, well placement, extraction well screened intervals, air injection pressure and flow and SVE recovery rate, must be considered in the final design for a corrective action plan (CAP).

Once you have reviewed the report, please call me if you have any questions.

Sincerely,



James E. Sadler
Engineer/Environmental

290092.REP

Attachment A

Acronyms and Definitions

A	Annulus - the space between the pipes and lines in the extraction well and the outer casing
AI (AS)	Air Injection (Sparging) the mass transfer of O_2 from air to groundwater
BGL	Below Ground Level
BGS	Below Ground Surface
BP	Barometric Pressure (Atmospheric Pressure)
BTOC	Below Top of Casing
CFH	Cubic Feet Per Hour
CFM	Cubic Feet Per Minute
DNAPL	Dense Non-Aqueous Petroleum Liquid
DPVE	Dual Phase Vacuum Extraction
DTGW	Depth to Groundwater
DTPSH	Depth to Phase Separated Hydrocarbons/LNAPL
DT	Drop Tube
EVR	Enhanced Vacuum Recovery, (SVE with air injection into the EW below the liquid level)
EW	Extraction Well
GW	Groundwater
GWD	Groundwater Depression
GWE	Groundwater Extraction
GWUP	Groundwater upwelling
HC	Hydrocarbon (Petroleum)
"H_2O	Inches of Water
"Hg	Inches of Mercury
IHG	Induced Hydraulic Gradient
IV	Induced Vacuum, normally from a vacuum pump connected to the extraction well or vapor recovery well
LEL	Lower Explosive Limit
LNAPL	Light Non-Aqueous Petroleum Liquid
MDP	Mobil Dual Phase
P	Pressure, the existence of above atmospheric pressure
PSH	Phase Separated Hydrocarbons
ROI	Radius of Influence
RPM	Revolutions per Minute
SCFM	Standard Cubic Feet per Minute
SVE	Soil Vacuum Extraction
TD	Total Depth
QT	Quick Test, a short duration SVE Test
V	Vacuum, the existence of below atmospheric pressure
VEGE	Vacuum Enhanced Groundwater Extraction
VER	Vacuum Enhanced Recovery
VEW	Vapor Extraction Well

12/19/09	Static Data Time 0755	First Data Time 0800	Second Data Time 0830	Third Data Time 0900	Fourth Data Time 0930	Fifth Data Time 1030	Sixth Data Time 1030
Horiba HC ppm	**NA**	**NA**	**20,040**	**NA**	**19,760**	**NA**	**26,850**
Horiba CO_2%	**NA**	**NA**	**1.64**	**NA**	**1.64**	**NA**	**1.70**
Horiba CO%	**NA**	**NA**	**0.11**	**NA**	**0.10**	**NA**	**0.25**
Horiba O_2%	**NA**	**NA**	**18.2**	**NA**	**17.9**	**NA**	**18.0**
LEL	**NA**	**NA**	**96**	**NA**	**94**	**NA**	**123**
Influent Vapor Temp °F	**-**	**56**	**56**	**56**	**56**	**56**	**56**
Barometric Pressure "Hg	**30.34**	**30.35**	**30.36**	**30.36**	**30.36**	**30.36**	**30.35**
Extraction Well Flow SCFM Well SVE-3	**OFF**	**17.55**	**17.55**	**17.55**	**20.38**	**20.38**	**25.97**
Extraction Well Vacuum "H_2O Well SVE-3	**OFF**	**15.0**	**15.0**	**15.0**	**20.0**	**20.0**	**35.0**
Well SCF-MW-10 Vacuum "H_2O Dist. 36.0 ft	**.02**	**.10**	**.19**	**.20**	**.23**	**.23**	**.31**
Well SVE-2 Vacuum "H_2O Dist. 43.0 ft	**.01**	**.05**	**.03**	**.06**	**.07**	**.07**	**.10**
Well SVE-1 Vacuum "H_2O Dist. 45.0 ft	**.01**	**.05**	**.05**	**.06**	**.09**	**.08**	**.08**
Well MW-6 Vacuum "H_2O Dist. 52.0 ft	**.01**	**.03**	**.06**	**.06**	**.06**	**.06**	**.09**
Well SVE-5 Vacuum "H_2O Dist. 64.0 ft	**.01**	**.03**	**.05**	**.05**	**.05**	**.05**	**.06**
Well MW-2 Vacuum "H_2O Dist. 118.0 ft	**.01**	**.01**	**.01**	**.01**	**.01**	**.01**	**.01**
Groundwater Upwelling - ft	**-**	**.458**	**1.254**	**1.758**	**2.060**	**2.054**	**3.158**

-() Indicates Well Pressure

NA - No Data Recorded

12/19/09	Seventh Data Time 1100	Eighth Data Time 1130	Ninth Data Time 1200	Tenth Data Time 1230	Eleventh Data Time 1300	Twelfth Data Time 1330
Horiba HC ppm	**NA**	**31,860**	**NA**	**27,650**	**NA**	**23,070**
Horiba CO_2%	**NA**	**1.84**	**NA**	**1.76**	**NA**	**1.70**
Horiba CO%	**NA**	**0.38**	**NA**	**0.19**	**NA**	**0.10**
Horiba O_2%	**NA**	**17.6**	**NA**	**18.1**	**NA**	**18.3**
LEL	**NA**	**146**	**NA**	**131**	**NA**	**92**
Influent Vapor Temp °F	**56**	**56**	**56**	**56**	**56**	**56**
Barometric Pressure "Hg	**30.35**	**30.34**	**30.33**	**30.32**	**30.31**	**30.30**
Extraction Well Flow SCFM Well SVE-3	**25.97**	**25.97**	**35.61**	**35.61**	**35.61**	**35.61**
Extraction Well Vacuum "H_2O Well SVE-3	**35.0**	**35.0**	**50.0**	**50.0**	**50.0**	**50.0**
Well SCF-MW-10 Vacuum "H_2O Dist. 36.0 ft	**.35**	**.36**	**.42**	**.43**	**.43**	**.44**
Well SVE-2 Vacuum "H_2O Dist. 43.0 ft	**.11**	**.12**	**.14**	**.15**	**.14**	**.14**
Well SVE-1 Vacuum "H_2O Dist. 45.0 ft	**.09**	**.09**	**.11**	**.11**	**.10**	**.09**
Well MW-6 Vacuum "H_2O Dist. 52.0 ft	**.09**	**.09**	**.14**	**.14**	**.16**	**.15**
Well SVE-5 Vacuum "H_2O Dist. 64.0 ft	**.05**	**.05**	**.06**	**.05**	**.07**	**.06**
Well MW-2 Vacuum "H_2O Dist. 118.0 ft	**.01**	**.02**	**.02**	**.01**	**.02**	**.02**
Groundwater Upwelling - ft	**3.164**	**3.173**	**4.170**	**4.250**	**4.242**	**4.171**

-() Indicates Well Pressure

NA - No Data Recorded

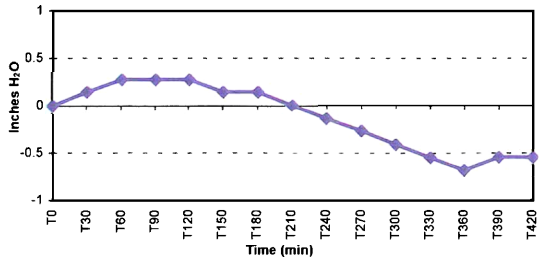
12/19/09	Thirteenth Data Time 1400	Fourteenth Data Time 1430	Fifteenth Data Time 1500	Static Data Time 1530	Average Data 7.0 Hrs	Maximum Data
Horiba HC ppm	**NA**	**17,190**	**NA**	**NA**	**23,774**	**31,860**
Horiba CO_2%	**NA**	**1.30**	**NA**	**NA**	**1.65**	**1.84**
Horiba CO%	**NA**	**0**	**NA**	**NA**	**0.16**	**0.38**
Horiba O_2%	**NA**	**18.4**	**NA**	**NA**	**18.1**	**18.4**
LEL	**NA**	**87**	**NA**	**NA**	**110**	**-**
Influent Vapor Temp °F	**56**	**56**	**56**	**NA**	**56**	**56**
Barometric Pressure "Hg	**30.29**	**30.30**	**30.30**	**30.30**	**30.33**	**30.36**
Extraction Well Flow SCFM Well SVE-3	**41.30**	**41.30**	**41.30**	**OFF**	**29.18**	**41.30**
Extraction Well Vacuum "H_2O Well SVE-3	**60.0**	**60.0**	**60.0**	**OFF**	**38.0**	**60.0**
Well SCF-MW-10 Vacuum "H_2O Dist. 36.0 ft	**.53**	**.55**	**.56**	**-**	**.36**	**.56**
Well SVE-2 Vacuum "H_2O Dist. 43.0 ft	**.15**	**.16**	**.16**	**0**	**.11**	**.16**
Well SVE-1 Vacuum "H_2O Dist. 45.0 ft	**.14**	**.15**	**.15**	**0**	**.10**	**.15**
Well MW-6 Vacuum "H_2O Dist. 52.0 ft	**.20**	**.21**	**.22**	**0**	**.12**	**.22**
Well SVE-5 Vacuum "H_2O Dist. 64.0 ft	**.06**	**.06**	**.09**	**-**	**.06**	**.09**
Well MW-2 Vacuum "H_2O Dist. 118.0 ft	**.02**	**.03**	**.02**	**-**	**.02**	**.03**
Groundwater Upwelling - ft	**5.143**	**5.172**	**5.163**	**-**	**3.293**	**5.172**

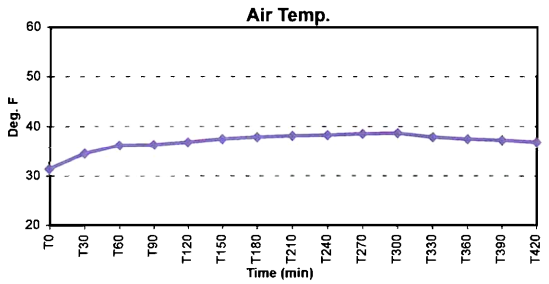
-() Indicates Well Pressure

NA - No Data Recorded

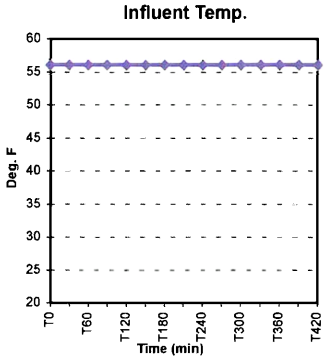
SCHEDULE B
Summary of ACUVAC TEST #SVE-3

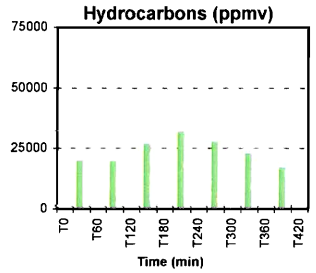
Atmospheric Conditions

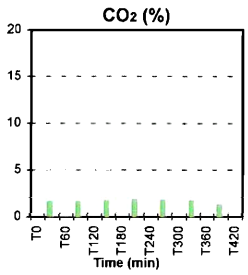


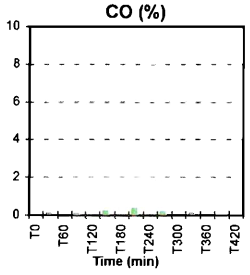


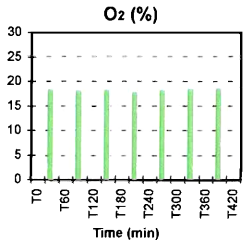
Influent Vapor Data

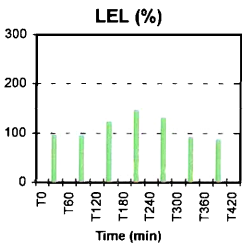


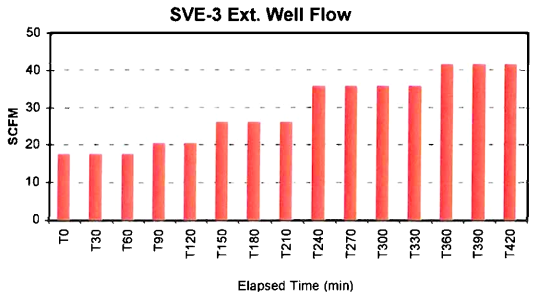


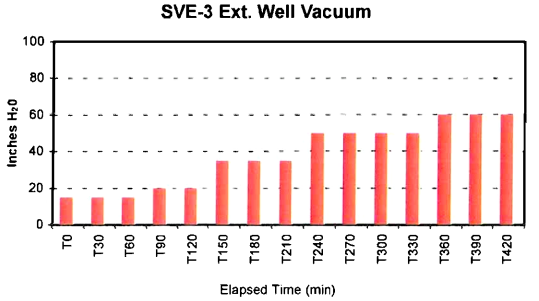


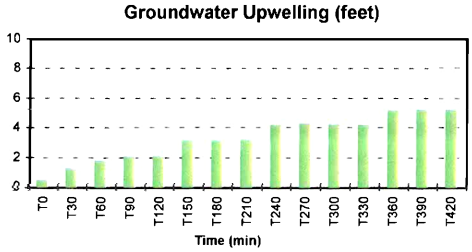






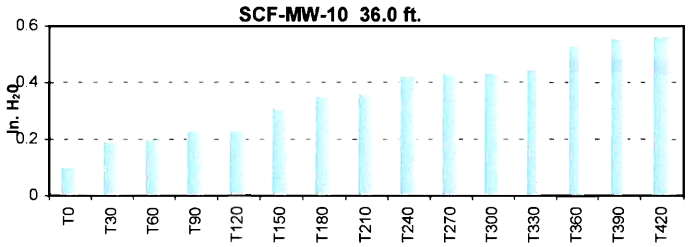


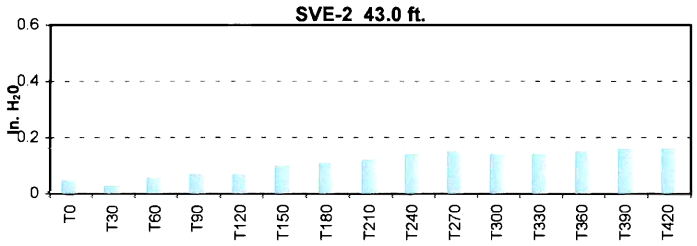


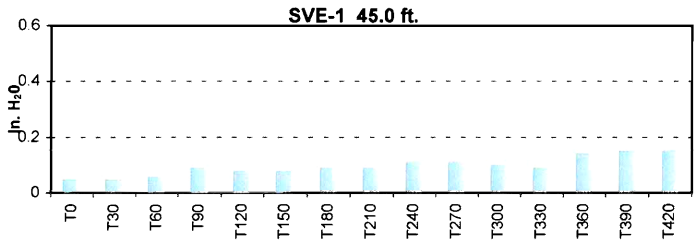


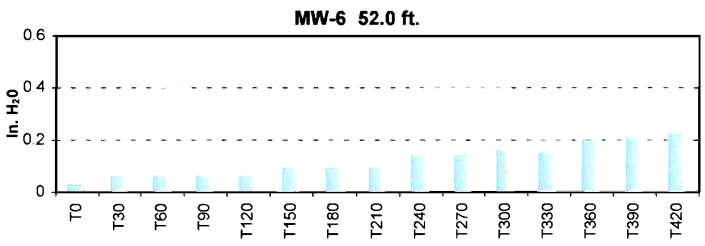
SCHEDULE B
Summary of ACUVAC TEST # SVE-3

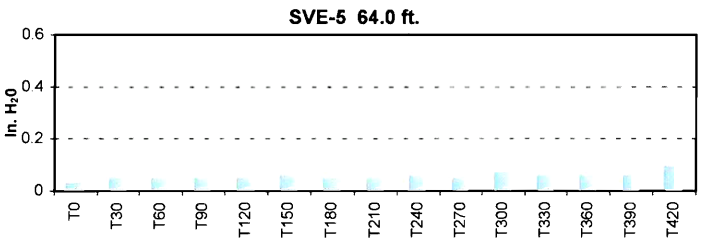
Recorded Well Vacuums and/or Pressures

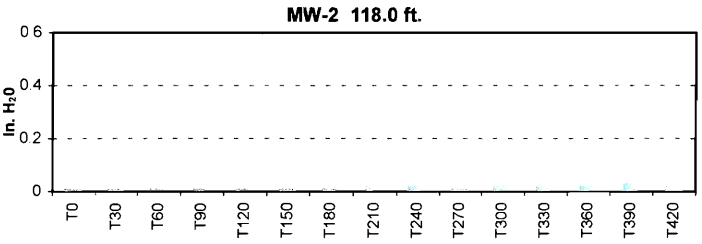


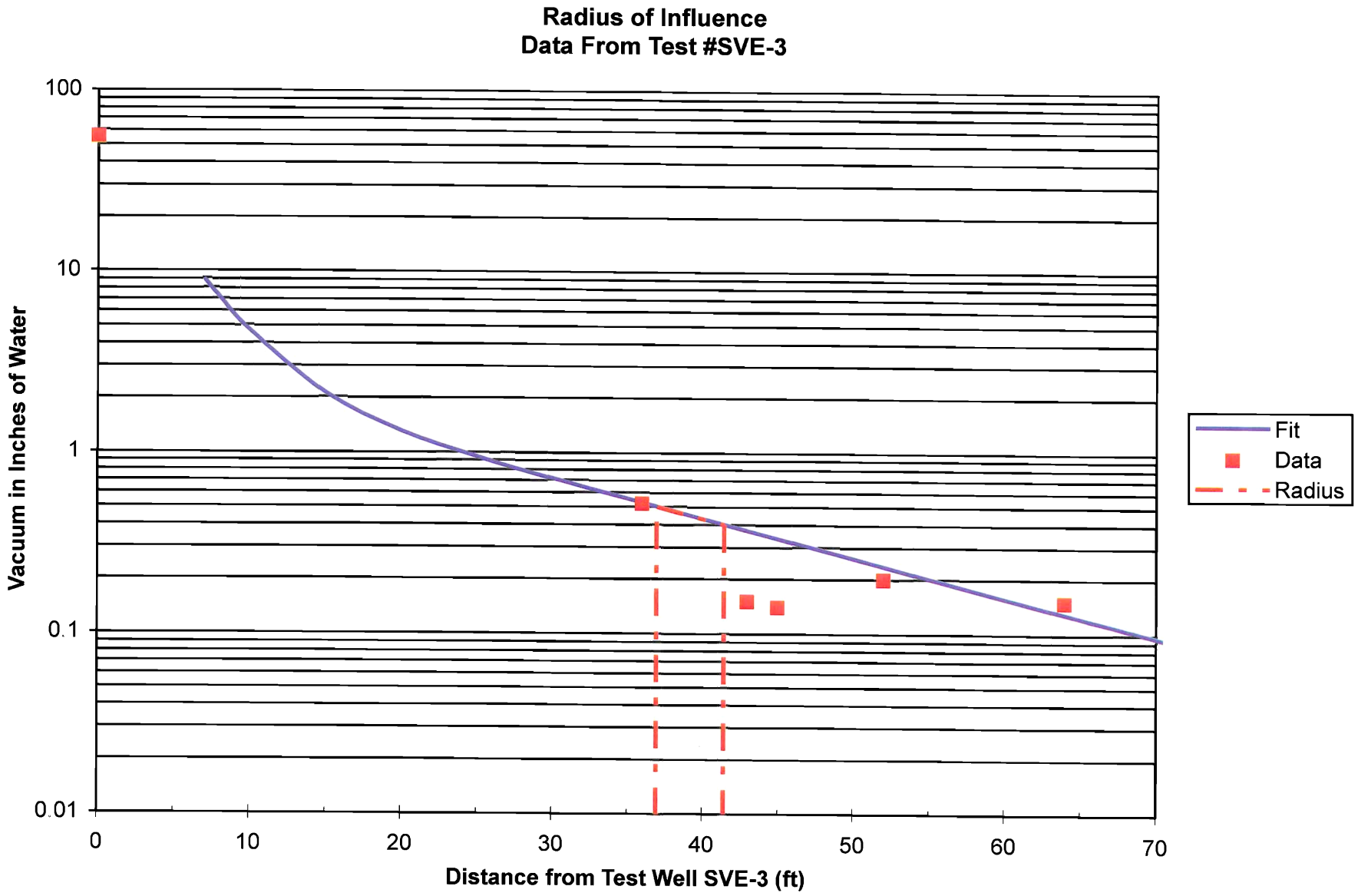











Radius of Influence
Data From Test #SVE-3
Vacuum in Inches of Water
100
10
1
0.1
0.01
0
10
20
30
40
50
60
70
Distance from Test Well SVE-3 (ft)
Fit
Data
Radius

OPERATING DATA - TEST # SVE-3 PAGE # 1 ACUVAC SVE SYSTEM

Location: MONTEZUMA REMEDIATION - SANTA FE, N.M. Project Engineer: SADUEN/LUNDGREN

	Date:	12-19-07	-	-	-	-	-
	Parameters	Time 0755	Time 0800	Time 0830	Time 0900	Time 0930	Time 1000
	WELL# SVE-3	Hr Meter 5094.9	Hr Meter 5095.0	Hr Meter 5095.5	Hr Meter 5096.0	Hr Meter 5096.5	Hr Meter 5097.0
ENGINEBLOWER	R.P.M.	1000	1800	1800	1800	1800	1800
	Oil Pressure psi	50	50	50	50	50	50
	Water Temp °F	120	145	145	160	160	160
	Volts	13	13	13	13	13	13
	Intake Vac. "Hg	18	18	18	18	18	18
	Gas Flow Fuel/Propane cfh	90	90	60	60	60	60
ATMOSPHERE/VAPOR/AIR	Dilution Air Flow scfm	20	18	18	18	15	15
	Extraction Well Flow scfm	OFF	17.55	17.55	17.55	20.38	20.38
	Extraction Well Vac. "H_2O	OF	15	15	15	20	20
	Influent Vapor Temp. °F	N/A	56	56	56	56	56
	Air Temp °F	31.3	31.4	34.4	36.1	36.2	36.8
	Barometric Pressure "Hg	30.34	30.34	30.35	30.36	30.36	30.36
	Absolute Pressure "Hg	23.80	23.80	23.81	23.82	23.82	23.82
MONITOR WELL VACUUM	36.0 SVE-MW-10 "H_2O	.02	.10	.14	.20	.23	.23
	43.0 SVE-2 "H_2O	.01	.05	.03	.06	.07	.07
	45.0 SVE-1 "H_2O	.01	.05	.05	.06	.04	.08
	52.0 MW-6 "H_2O	.01	.03	.06	.06	.06	.06
	64.0 SVE-5 "H_2O	.01	.03	.05	.05	.05	.05
	118.0 MW-3 "H_2O	.01	.01	.01	.01	.01	.01
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
	WELL FLOW SCFM H2O	-	1.17	1.17	1.17	1.02	1.02
MANIFOLD	SVE ON/OFF	OFF	ON	ON	ON	ON	ON
	Data Logger ft	7.954	8.412	9.208	9.712	10.014	10.008
	GW Upwelling ft	-	+0.458	+1.254	+1.758	+2.060	+2.054
	Extraction Well DTPSH	28.57					
	Extraction Well DTGW	29.94					

() Indicates Well Pressure

TEST	Instrument	HORIBA	HORIBA				
	Well	SVE-3	SVE-3				
	Time	0845	0945				
VAPOR/INFLUENT	HC ppmv	20,040	19,760				
	CO_2 %	1.64	1.64				
	CO %	.11	.10				
	O_2 %	18.2	17.9				
	LEL %	96	94				

OPERATING DATA AND NOTES
MONTEZUMA REMEDIATION

DATE: 12/14/09 TEST NO: SVE-3 Page No: 1

0700	Arrived @ site - positioned SVE System near well SVE-3 as the extraction well
	(EW) Mobilized SVE equipment - Gauged wells - plugged wells - Install data logger
	in EW - Safety checks - all OK - EW temperature = 61.974°F
0750	Recorded Static Well Data: All outer wells, slight vacuums - DTW = 7.954'
0800	START TEST SVE-3 - Initial EW induced vacuum set @ 15" H_2O, Vapor well
	flow @ 17.55 scfm - GW UP = 0.458'
0830	Recorded data BP ↑ - All outer wells recording an increased vacuum level
	GW UP = +1.254'
0845	HORIBA DATA: TPH= HC = 20,040 ppmv, CO_2 = 1.64% CO = 0.11% - O_2 = 18.7%
0900	Recorded data: BP ↑ All outer wells (X MW-2) continue on a slight
	increasing vacuum trend. GW UP = 1.758'
	Increased EW vacuum to 20" H_2O, vapor well flow = 20.38 scfm
0930	Recorded data: BP - Outer wells recording slight vacuum increases
	to remaining steady on the more distant wells - GW UP = +2.060
1000	Recorded data: BP - Outer wells mostly steady - GW UP = 2.054'
	INCREASED EW vacuum to 35" H_2O, Vapor Well Flow = 25.97 scfm
0945	HORIBA DATA: HC = 19,760 ppmv ↓, CO_2 = 1.64% —, CO = 0.10% ↓, O_2 = 17.9% ↓

Form/19950

OPERATING DATA - TEST # SVE-3 PAGE # 2 ACUVAC SVE SYSTEM

Location: MONTEZUMA REMEDIATION SANTA FE, NM Project Engineer: SADLER / LUNDGREN

	Date:	12-19-09	"	"	"	"	"
	Parameters	Time 1030	Time 1100	Time 1130	Time 1200	Time 1230	Time 1300
		Hr Meter	Hr Meter	Hr Meter	Hr Meter	Hr Meter	Hr Meter
	WELL SVE-3	5097.5	5098.0	5098.5	5099.0	5099.5	5100.0
ENGINE/BLOWER	R.P.M.	2000	2000	2000	2300	2300	2300
	Oil Pressure psi	50	50	50	50	50	50
	Water Temp °F	160	160	160	160	160	160
	Volts	13	13	13	13	13	13
	Intake Vac. "Hg	17	17	17	16	16	16
	Gas Flow Fuel/Propane cfh	30	30	30	0	0	10
ATMOSPHERE/VAPOR/AIR	Dilution Air Flow scfm	12	12	12	17	17	17
	Extraction Well Flow scfm	25.97	25.97	25.97	35.61	35.61	35.61
	Extraction Well Vac. "H_2O	35	35	35	50	50	50
	Influent Vapor Temp. °F	56	56	56	56	56	56
	Air Temp °F	37.4	37.7	38.0	38.2	38.4	38.5
	Barometric Pressure "Hg	30.35	30.35	30.34	30.33	30.32	30.31
	Absolute Pressure "Hg	23.81	23.81	23.80	23.79	23.78	23.77
MONITOR WELL VACUUM	SFC-MW-10 "H_2O	.31	.35	.36	.42	.43	.43
	SVE-2 "H_2O	.10	.11	.12	.14	.15	.14
	SVE-1 "H_2O	.08	.09	.09	.11	.11	.10
	MW-6 "H_2O	.09	.09	.09	.14	.14	.16
	SVE-3 "H_2O	.06	.05	.05	.06	.05	.07
	MW-2 "H_2O	.01	.01	.02	.02	.01	.02
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
	WELL FLOW PER IN. HG	0.74	0.74	0.74	0.71	0.71	0.71
MANIFOLD	SVE ON/OFF	ON	ON	ON	ON	ON	ON
	Data Logger -1.454 ft	11.112	11.118	11.127	12.124	12.204	12.196
	GW Upwelling ft	+3.158	+3.164	+3.173	+4.170	+4.250	+4.242
	Extraction Well DTPSH						
	Extraction Well DTGW						

() Indicates Well Pressure

TEST	Instrument	HORIBA	HORIBA				
	WELL #	SVE-3	SVE-3				
	Time	1045	1215				
VAPOR/INFLUENT	HC ppmv	26,850	31,860				
	CO_2 %	1.70	1.84				
	CO %	.25	.38				
	O_2 %	18.0	17.6				
	LEL %	123	146				

OPERATING DATA AND NOTES

DATE: 12/19/04 MONTEZUMA REMEDIATION TEST NO SVE-3 Page No: 3

1030	Recorded data: BP ↓ Outer wells within 50' of SVE-3 are continuing to respond to the EW induced vacuum - GWUP: +3.164'
1045	HORIBA DATA: HC = 26,850 ppmv ↑, CO_2 = 1.70% ↑, CO = 0.25% ↑, O_2 = 18.0% ↑
1100	Recorded Data: BP - Outer wells within 50, slight increased vacuum levels - GWUP +3.164'
1130	Recorded Data: BP ↓ Outer wells mostly steady - GWUP: +3.173' INCREASED EW vacuum = 50" H_2O, Vapor well flow = 35.61 scfm
1200	Recorded Data: BP ↓ All outer wells recorded increased levels of vacuum in response to EW ↑
1215	HORIBA DATA: HC = 31,860 ppmv ↑, CO_2 = 1.84% ↑, CO = 0.38% ↑, O_2 = 17.6% ↓
1230	Recorded Data: BP ↓ Outer well variable - slight increases on close wells, other wells mostly steady - GWUP: +4.250'
1300	Recorded Data: BP ↓ Outer wells slightly variable, steady, increases/decreases - GWUP: +4.242'

Form/19950

OPERATING DATA - TEST # SVE-3 PAGE # 3 ACUVAC SVE SYSTEM

Location: MONTEZUMA REMEDIATION - SANTA FE, NM Project Engineer: SADLER/LUNDQUIEN

	Date:	12-14-09	-	-	-	-	-
	Parameters	Time	Time	Time	Time	Time	Time
		1330	1400	1430	1500	1510	1530
		Hr Meter	Hr Meter	Hr Meter	Hr Meter	Hr Meter	Hr Meter
	WELL SVE-3	5100.5	5101.0	5101.5	5102.0	5102.1	5102.5
ENGINE/BLOWER	R.P.M.	2300	2700	2700	2700	1000	1000
	Oil Pressure psi	50	50	50	50	50	50
	Water Temp °F	160	160	160	160	140	140
	Volts	13	13	13	13	13	13
	Intake Vac. "Hg	16	16	16	16	18	18
	Gas Flow Fuel/Propane cfh	15	20	25	25	90	40
ATMOSPHERE/VAPOR/AIR	Dilution Air Flow scfm	17	15	15	15	24	24
	Extraction Well Flow scfm	35.61	41.30	41.30	41.30	OFF	OFF
	Extraction Well Vac. "H_2O	50	60	60	60	OFF	OFF
	Influent Vapor Temp. °F	56	56	56	56	N/A	N/A
	Air Temp °F	37.7	37.4	37.1	36.8	32.2	37.1
	Barometric Pressure "Hg	30.30	30.29	30.30	30.30	30.30	30.30
	Absolute Pressure "Hg	23.76	23.75	23.76	23.76	23.76	23.76
MONITOR WELL VACUUM	SFC-MW-10 "H_2O	.44	.53	.55	.56	-	-
	SVE-2 "H_2O	.14	.15	.16	.16	-	0
	SVE-1 "H_2O	.09	.14	.15	.15	-	0
	MW-6 "H_2O	.15	.20	.21	.22	-	0
	SVE-5 "H_2O	.06	.06	.06	.09	-	-
	MW-2 "H_2O	.02	.02	.03	.02	-	-
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
	WELL FLOW PER IN. H_2O	0.71	0.69	0.69	0.69		
MANIFOLD	SVE ON/OFF	ON	ON	ON	ON	OFF	OFF
	Data Logger 1.454 ft	12.125	13.097	13.126	13.117	-	-
	GW Upwelling ft	+4.171	+5.143	+5.172	+5.163	-	-
	Extraction Well DTPSH					28.34	26.33
	Extraction Well DTGW					29.40	27.58

STATIC

() Indicates Well Pressure

NAPL = 1.04 1.23

TEST	Instrument	HORIBA	HORIBA	HORIBA			
	WELL #	SVE-3	SVE-3	SVE-3			
	Time	1315	1345	1445			
VAPOR/INFLUENT	HC ppmv	27,650	23,070	17,140			
	CO_2 %	1.76	1.70	1.30			
	CO %	.19	.10	0			
	O_2 %	18.1	18.3	18.4			
	LEL %	131	92	87			

OPERATING DATA AND NOTES

DATE: 12/19/09 MONTEZUMA REMEDIATION TEST NO: SVE-3 Page No: 3

1315	HORIBA DATA: HC = 27,650 ppmv ↓, CO_2 = 1.76% ↓, CO = 0.19% ↓, O_2 = 18.1% ↑
1330	Recorded Data: BP ↓ Outer wells variable - Slight increase/decrease
	GWUP = +4.171'
	INCREASED: EW vacuum = 60 "H2O, Vapor well flow = 41.30 scfm
1345	HORIBA DATA: HC = 23,070 ppmv ↓, CO_2 = 1.70% ↓, CO = 0.10% ↓, O_2 = 18.3% ↑
1400	Recorded Data: BP ↓ Outer wells within 50' of EW recorded increased
	vacuum levels, other wells steady - GWUP = +5.143
1430	Recorded Data: BP ↑ Outer wells continue on slight increasing
	trend - GWUP = +5.172'
1445	HORIBA DATA: HC = 17,140 ppmv ↓, CO_2 = 1.30% ↓, CO = 0% ↓, O_2 = 18.4% ↑
1500	Recorded data: BP - Outer wells variable, slight increase to
	remaining steady - GWUP +5.167'
1510	Gauged outer wells - Discontinued SVE to allow time
	for outer wells to adjust to atmospheric changes
1540	Recorded static data: Wells SVE-1, 2 and MW-6 = 0 "H2O
	Demobilized - Secured wells
1615	- SVE QT - Well SVE-4
1700	Loaded all equipment - departed site

Form/1995O

OPERATING DATA - TEST # SVE-QT-4 ACUVAC SVE SYSTEM

Page: 1 Location: MONTEZUMA REMEDIATION - SANITAFE Project Engineer: SANDER / LUNDGREN

		Date:	12-18-04	-	-	-	-	-
Parameters			Time	Time	Time	Time	Time	Time
			1230	1300	1330	1400	1430	1500
			Hr Meter	Hr Meter	Hr Meter	Hr Meter	Hr Meter	Hr Meter
			50920	50925	50930	5093.5	5094.0	5094.5
IDENTIFICATION/ VAPOR DATA	Well No.		SVE-2	SVE-3	SVE-1	MW-6	MW-5	MW-7
	INFLUENT VAPOR							
	HC	ppmv	792	20,710	7,270	45,880	1,782	9,440
	CO_2	%	1.14	1.12	5.14	8.66	9.54	10.12
	CO	%	0	.11	.01	0.92	0	0
	O_2	%	20.4	18.3	13.0	5.3	7.1	6.8
FUEL/ AIR	Fuel/Propane	cfh	100	30	90	40	100	70
	Dilution Air	cfm	N/A	-	-	-	-	-
VAC/ FLOW	Well Vacuum	"H_2O	20	35	15	40	40	40
	Well Flow	scfm	20.48	22.15	24.52	15.31	7.66	15.31
OTHER	Air Temp	°F	34.2	34.4	35.4	SUN 43.2	SUN 42.1	SUN 38.9
	Barometric Pressure	"Hg	30.26	30.26	30.25	30.24	30.24	30.22
	DTLNPL	ft	-	28.61	29.69	30.41	-	TRACE
	DTGW	ft	28.64	29.84	29.76	30.50	31.18	31.49

OPERATING DATA AND NOTES

1230	START TEST SVE-QT-4A - WELL SVE-2 - Induced Vacuum @ 20" H_2O
1245	COMPLETED TEST QT-4A - LOW HC levels
1300	START TEST SVE-QT-4B - WELL SVE-3 - Induced vacuum @ 35" H_2O
1315	COMPLETED TEST QT-4B - NAPL @ 1.23' HC @ 20K +
1330	START TEST SVE-QT-4C WELL SVE-1 - Induced vacuum @ 15" H_2O
1345	COMPLETED TEST QT-4C NAPL @ 0.08' HC @ 7.27K
1400	START TEST SVE-QT-4D WELL MW-6 - Induced vacuum @ 40" H_2O
1415	COMPLETED TEST QT-4D - NAPL @ 0.09' - HC @ 45.8K
1430	START TEST SVE-QT-4E - WELL MW-5 - Induced vacuum @ 40" H_2O
1445	COMPLETED TEST QT-4E - NO NAPL Recorded
1500	START TEST SVE QT-4F - WELL MW-7 - Induced vacuum @ 40" H_2O
1515	COMPLETED TEST QT-4F - Recorded a trace of NAPL

OPERATING DATA - TEST # SVE-QT-4 ACUVAC SVE SYSTEM

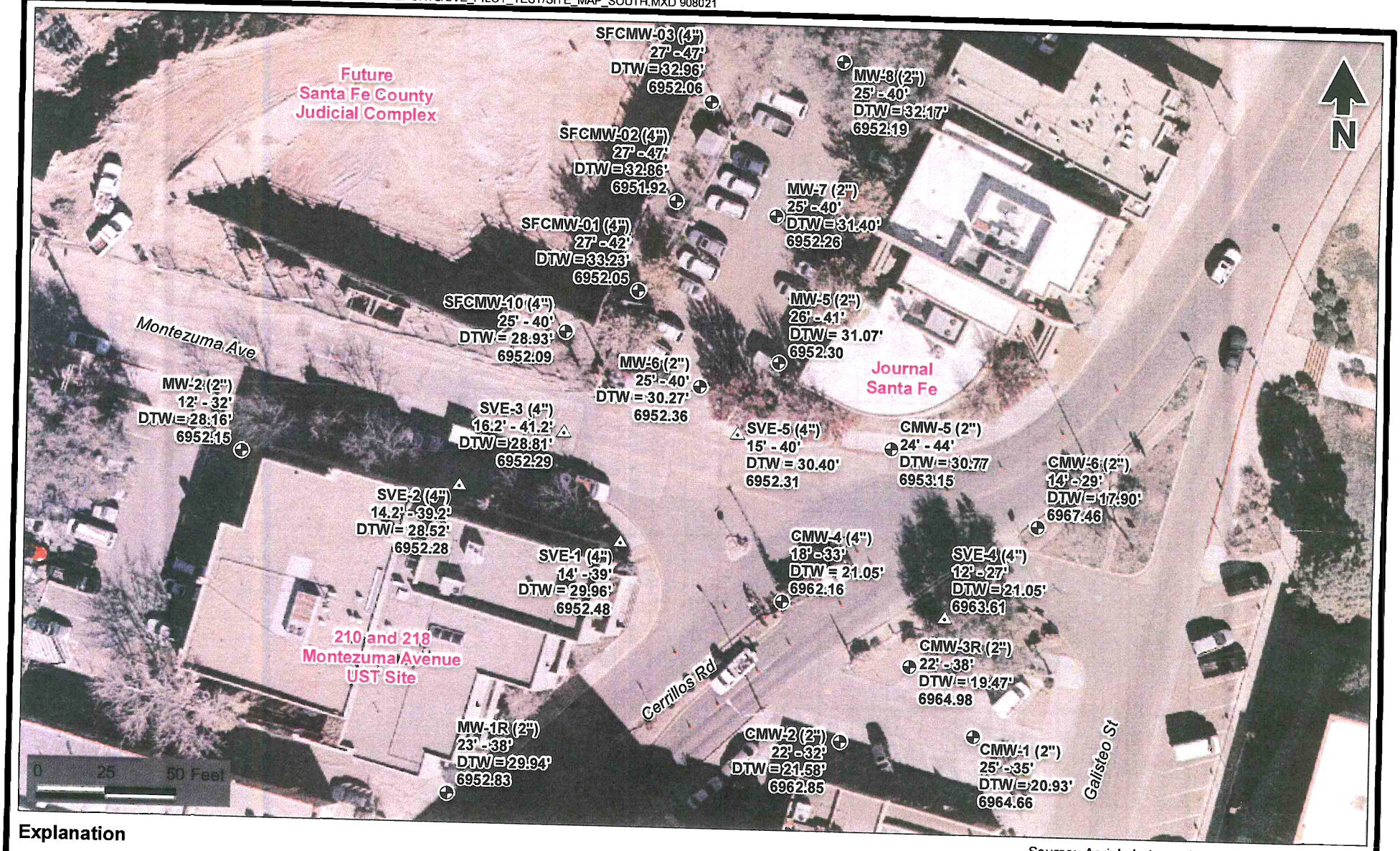
Page: 2 Location: MONTEZUMA REMEDIATION - SANTA FE Project Engineer: BADGER / LUNDSTROM

		Date:	12-14-04					
Parameters			Time 1615	Time	Time	Time	Time	Time
			Hr Meter 5103.0	Hr Meter	Hr Meter	Hr Meter	Hr Meter	Hr Meter
IDENTIFICATION/ VAPOR DATA	Well No.		SVE-4					
	INFLUENT VAPOR							
	HC	ppmv	74					
	CO_2	%	2.00					
	CO	%	0					
	O_2	%	19.8					
FUEL/ AIR	Fuel/Propane	cfh	110					
	Dilution Air	cfm	N/A					
VAC/ FLOW	Well Vacuum	"H_2O	40					
	Well Flow	scfm	24.09					
OTHER	Air Temp	°F	37.1					
	Barometric Pressure	"Hg	30.30					
	DTLNAPL	ft	-					
	DTGW	ft	21.49					

OPERATING DATA AND NOTES

1615	START TEST SVE-QT-4G - WELL SVE-4 - Induced Vacuum 40"Hg
1630	COMPLETED TEST QT-4G - Minimal HC Level - High O_2

S:/PROJECTS/ES09.0215_MONTEZUMA_REMEDIATION/GIS/MXDS/REPORTS/SVE_PILOT_TEST/SITE_MAP_SOUTH.MXD 908021



Explanation

- Existing monitor well
- Existing SVE well

Source: Aerial photograph dated November 2, 2009 flown by TRM

Figure 1

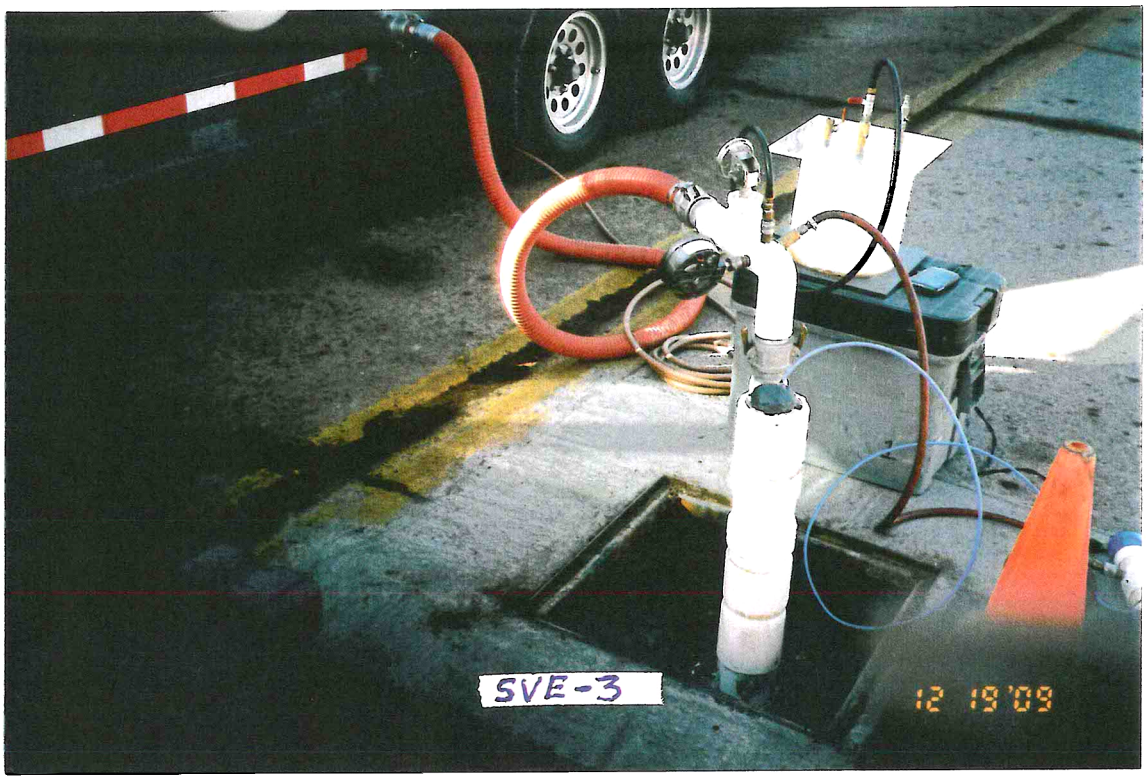
Daniel B. Stephens & Associates, Inc.
12/08/2009
JN ES09.0215

SANTA FE COUNTY JUDICIAL COMPELX

Well Location Summary

MONTEZUMA REMEDIATION PROJECT
SANTA FE, NM

MONTEZUMA REMEDIATION PROJECT
SANTA FE, NM



AcuVac Remediation Inc.

1656-H Townhurst, Houston, Texas 77043
713.468.6688 · fax:713.468.6689 · www.acuvac.com

November 14, 2009

Mr. Gundar Peterson, P.E.
Daniel B. Stephens & Associates
6020 Academy Rd. N.E., Suite 100
Albuquerque, NM 87109

Dear Gundar:

Re: Montezuma Remediation, 210-218 Montezuma Ave., Santa Fe, NM
Project # E509.0215

Following is the report on **Soil Vacuum Extraction (SVE) Pilot Testing** performed on November 7 & 8, 2009, at the above referenced location. Two tests were conducted using AcuVac's SVE I-6 System, with Roots RAI-33 blower, various instrumentation, including the HORIBA Analyzer, Lumidor O_2 and LEL Analyzer, MMC and Solinst Interface Probes, magnehelic gauges, Dwyer digital manometer, flow gauges, a sensitive instrument to determine barometric pressure and absolute pressure, V-1 Vacuum Box to capture non-diluted vapor samples and other special equipment. The test consisted of two extended tests. An Engineer and Geologist with over 14,000 hours of on-site testing conducted the Pilot Tests. The total test time including static data time was 16 hours.

Introduction

The vacuum extraction portion of the AcuVac SVE System consists of a vacuum pump driven by an internal combustion (IC) engine. The vacuum pump is connected to the extraction well and the vacuum created on the extraction well causes hydrocarbons in the soil to volatilize and flow through a moisture knockout tank to the vacuum pump and the internal combustion engine where they are burned as part of the normal combustion process. Propane is used as an auxiliary fuel to help power the engine if the well vapors do not provide the required BTU.

Emissions from the engine are passed through three catalytic converters to ensure maximum destruction of removed hydrocarbon vapors. The engine's fuel to air ratio can be adjusted to maintain efficient combustion. Because the engine is the power source for all equipment, all systems stop when the engine stops. This eliminates any uncontrolled release of hydrocarbons. Since the System is held entirely under vacuum, any leaks in the seals or connections are leaked into the System and not emitted into the atmosphere. The engine is automatically shut down by vacuum loss, low oil pressure or overheating.

The sites are located mainly in paved parking lots and city streets which substantially provided an impermeable barrier to reduce SVE short-circuiting. However, SVE short-circuiting most likely occurred during test SVE-2 through the location of underground utilities adjacent to the SVE extraction well.

SVE Test Objectives:

- Evaluate the potential for removing vapor phase LNAPL from the vadose zone.
- Provide data on the vapor phase concentrations in the influent vapors.
- Determine the SVE radius of influence to remove vapor phase LNAPL.

Project Scope:

- Open selected outer observation wells and install In-Situ data logger in extraction wells (SVE-5 & 9) to record liquid level changes.
- Connect the AcuVac System to extraction wells (EW) SVE 5 & 9, record the static well data, DTGW/DTLNAPL, well size, TD and screen intervals and then apply vacuum. Record the vacuum and well flow, all System data (including fuel flow of propane), temperature, barometric pressure and absolute pressure.
- Set the SVE induced vacuum and well vapor flow at the selected range.
- The test procedures are to provide variable rates of vacuum and flow over the test period and record the data at a selected interval of time.
- Install and observe the magnehelic gauges or connect a digital manometer on the outer observation wells to determine if the selected EW is in vacuum communication with the outer observation wells. Record the data at a selected interval of time.
- Collect non-diluted influent vapor samples to provide on-site HORIBA Analyzer analytical data consisting of TPH up to 100,000 ppmv, CO_2%, CO% and O_2%.
- Record the vacuums/pressures on the outer monitoring wells.
- Record the distances from the selected EW to the outer wells.
- Operate the SVE System in such a manner that all well vapors are passed through the engine and catalytic converters to destruct the contaminants, and exhausted, meeting air emission standards. Comply with all safety regulations.
- Complete the tests by providing a report consisting of operating and analytical data, and projection of an SVE radius of influence.

Attached Schedules:

Well Data Information:

TABLE #1 - TEST #SVE-1

WELL NO.		SVE-9	MW-11	MW-12	SCF-MW-11	SCF-MW-7	SCF-MW-12	EW/ GWUP [2]	EW/ WF [3]	EW/ VAC [4]
TD	ft	34.0	34.0	34.5	37.0	34.0	38.0	-	-	-
Screen	ft	19.0-34.0	19.0-34.0	19.5-34.5	22.0-37.0	24.0-34.0	23.0-38.0	-	-	-
Well size	in	4.0	2.0	2.0	2.0	2.0	2.0	-	-	-
DTGW - 0755 Hrs - Static	ft	27.42	26.12	26.92	25.74	27.23	25.76	-	-	-
DTGW - Hydro Equivalent	ft	26.23	26.12	26.92	25.74	27.23	25.76	-	-	-
DTLNAPL - 0755 Hrs - Static	ft	25.82	-	-	-	-	-	-	-	-
LNAPL- 0755 Hrs - Static	ft	1.60	-	-	-	-	-	-	-	-
Data Logger - 0755 Hrs - Static	ft	7.253	-	-	-	-	-	0	0	0
Data Logger - 0800 Hrs - Start SVE	ft	13.648	-	-	-	-	-	6.395	8.83	90.0
Data Logger - 0830 Hrs	ft	11.751	-	-	-	-	-	4.498	4.97	75.0
Data Logger - 0900 Hrs	ft	11.825	-	-	-	-	-	4.572	4.97	75.0
Data Logger - 0930 Hrs	ft	12.040	-	-	-	-	-	4.787	4.97	75.0
Data Logger - 1000 Hrs	ft	12.151	-	-	-	-	-	4.898	4.97	75.0
Data Logger - 1030 Hrs	ft	12.224	-	-	-	-	-	4.971	4.97	75.0
Data Logger - 1100 Hrs	ft	11.351	-	-	-	-	-	4.098	3.92	60.0
Data Logger - 1130 Hrs	ft	11.376	-	-	-	-	-	4.124	3.92	60.0
Data Logger - 1200 Hrs	ft	11.520	-	-	-	-	-	4.267	3.92	60.0
Data Logger - 1230 Hrs	ft	11.403	-	-	-	-	-	4.150	3.92	60.0
Data Logger - 1300 Hrs	ft	11.587	-	-	-	-	-	4.334	3.92	60.0
Data Logger - 1330 Hrs	ft	11.562	-	-	-	-	-	4.309	3.92	60.0
Data Logger - 1400 Hrs	ft	11.621	-	-	-	-	-	4.368	3.92	60.0
Data Logger - 1430 Hrs	ft	12.632	-	-	-	-	-	5.379	5.30	90.0
Data Logger - 1500 Hrs	ft	12.900	-	-	-	-	-	5.647	5.30	90.0
Data Logger - 1530 Hrs - Stop SVE	ft	13.288	-	-	-	-	-	6.035	5.30	90.0
Data Logger - 1600 Hrs - Static	ft	7.426	-	-	-	-	-	0.173	0	0
DTGW - 1530 Hrs	ft	26.25	25.06	26.84	25.64	27.22	25.87	-	-	-
DTGW - Hydro Equivalent	ft	23.73	25.06	26.84	25.64	27.22	25.87	-	-	-
DTLNAPL - 1530 Hrs	ft	22.85	-	-	-	-	-	-	-	-
LNAPL- 1530 Hrs	ft	3.40	-	-	-	-	-	-	-	-
GW Level Decreases (+)/Increases (-) Based on Hydro Equivalent	ft	+4.70 [1]	+1.06	+0.08	+0.10	+0.01	-(0.11)	-	-	-
Distance from SVE-9	ft	0	15.0	23.0	42.0	52.0	53.0	-	-	-

1. Average GW/LNAPL upwelling/FT
2. GW/LNAPL upwelling during test period/FT
3. SVE Well Flow - scfm
4. SVE Induced Vacuum/"H_2O

Note: (a) Specific Gravity = 0.74

(b) The liquid upwelling is greater than the recorded data due to the difference in specific gravity of LNAPL and GW. The data logger is set for a specific gravity of 1.0.

TEST SVE-1: Well # SVE-9

Pre Test Functions

Prior to starting these tests, all the SVE systems were checked for normal operation. The depth to groundwater (DTGW) and depth to light non-aqueous petroleum hydrocarbon (DTLNAPL) levels were recorded. Each magnehelic gauge was checked and calibrated to zero. The outer monitoring wells were plugged with expandable well plugs designed to accept magnehelic gauges and the digital manometer. Static well data was recorded prior to engaging the SVE System. The In-Situ data logger was installed in the EW wells. The propane tank fuel level was recorded so that an accurate fuel consumption could be estimated for the total test periods. The HORIBA Analyzer was set for the local altitude and calibrated with SPAN gas, which consists of Hexane and CO_2. All safety checks were performed on the System.

Discussion of Data: - Test SVE-1

Test #SVE-1 was an 8.0 hour SVE test, including the time for static well data, conducted from well SVE-9 as the vapor extraction well (EW). **The LNAPL thickness in EW was 1.60 ft.** Static well data indicated that the selected outer monitoring wells were recording slight vacuums ranging from 0.01 to 0.07"H_2O. The barometric pressure was steady at 30.28"Hg and the ambient air temperature was 49.4°F. **At the start of this 2.5 hour test period, the initial EW vacuum was 90.0"H_2O,** with a flow of 8.83 scfm. **Due to GW upwelling,** the EW vacuum was immediately decreased to 75.0"H_2O, with a vapor well flow of 4.97 scfm. The influent vapor temperature was 68°F and the GW temperature was 60.48°F. All the outer wells, MW-11 & 12, and SCF-MW-7, 11 & 12, recorded an increasing vacuum trend for 2.0 hours and were then steady to slightly variable during the next 0.5 hours. Well MW-11 recorded an abnormally high vacuum in relation to its location from SVE-9. Well SCF-MW-12 initially recorded an increasing vacuum trend which rapidly decreased to lower levels and then to a well pressure. During this test period, the average recorded GW/LNAPL upwelling was 4.75 ft. The upwelling had a significant effect on the available well screen of 7.23 ft based on hydro-equivalent. Since the data logger is programmed for a specific gravity of 1.0 and approximately 1 to 3 ft of LNAPL was collected in the EW, the available screen was less than indicated by the data logger.

The HORIBA Emission Analytical instrument is an accurate field instrument that will record TPH levels up to 100,000 ppmv and CO_2 levels up to 25%. During this initial test period, the HORIBA analytical data indicated the three influent vapor samples taken from the EW had hydrocarbon concentrations (HC) of 83,290, 86,340 and 81,190 ppmv, with CO_2 at 2.34, 3.18 and 3.29%, CO of 6.35, 5.16 and 5.03%, O_2 levels of 6.35, 5.16 and 5.03% and LEL levels of 207, 216 and 207%. The propane flow was recorded at 20 cfh, with a well flow of 4.97 scfm. The influent vapors had a substantially high HC concentration due to the LNAPL in well SVE-9 and the highly saturated vadose zone.

After 2.5 hours of steady induced vacuum, **the EW vacuum was decreased to 60.0"H_2O**, with a flow of 3.92 scfm. The EW vacuum was decreased to reduce the GW/LNAPL upwelling. This test period was 3.5 hours. The outer wells initially recorded a decreasing vacuum trend in response to the decreased induced vacuum and then remained mostly steady with slight increases and decreases. Well SCF-MW-12 continued to record increased well pressures. The barometric pressure decreased from 30.28 to 30.20"Hg during this test period. The influent vapor temperature remained constant at 68°F and the ambient air temperature increased to 55.6°F. The average GW upwelling was 4.24 ft above static level. The available remaining screen for SVE vapor flow was less than 3.0 ft. This indicates the well flow per foot of screen was approximately 2.0 scfm/ft.

Generally, a decreasing barometric pressure results in increased well pressures (decreased vacuums) on those wells plugged and sealed at the TOC, while an increasing barometric pressure results in increased well vacuums. **There are many variables that can affect Pilot Test data, but barometric pressure oscillations have the most immediate and profound effect.**

The purpose of a variable rate flow test is to define the pressure/flow characteristics of sub-surface soils around the EW and to estimate potential conditions for operational SVE Systems. Starting a test with lower variable rate vacuum and flow increases, allows the EW and outer wells sufficient time to adjust and stabilize, and minimizes the risk of developing preferential paths. This will also assist the development of newly installed vapor extraction wells.

HORIBA analytical data indicated the three influent vapor samples taken from the EW during this test period had HC of 72,550, 81,340 and 79,400 ppmv, with CO_2 at 3.29, 4.08 and 4.47%, CO levels of 3.50, 4.77 and 4.47%, O_2 levels of 11.7, 9.2 and 10.1% and LEL levels of 209, 184 and 193%. The propane flow was recorded at 30 cfh, with a well flow of 3.92 scfm. The influent vapors continued to record a high HC concentration. The effluent (engine emissions) from an exhaust sample from the catalytic converters had an HC level of 476 ppmv and CO_2 at 6.23%.

After 3.5 hours of steady vacuum of 60.0"H_2O, the final induced vacuum was increased to 90.0"H_2O, with a well flow of 5.30 scfm. The test period was 1.5 hours. The barometric pressure decreased from 30.20 to 30.18"Hg. The ambient air temperature increased to 60.1°F and then decreased to 53.8°F. The influent vapor temperature was steady at 68°F. The outer wells recorded a slight increasing vacuum trend in response to the EW vacuum increase. The GW upwelling averaged 5.69 ft above static hydro-equivalent level. This reduced the available screen to approximately 1.5 ft.

Additional HORIBA analytical data indicated the two influent vapor samples taken from the EW, had HC concentrations of 87,190 and 83,190 ppmv, CO_2 at 3.00 and 3.28%, CO at 6.80 and 5.60%, O_2 levels of

10.9 and 12.9% and LEL levels of 225 and 203%. The propane flow was recorded at zero, with a well flow of 5.30 scfm. The increase in the TPH levels may indicate that the well gas vapors were being pulled through the LNAPL due to the upwelling and the limited screen area. Also, **at the conclusion of the Test, the LNAPL thickness in EW was 3.40 ft. This resulted in an LNAPL thickness increase of 1.8 ft.**

An Important Observation

At the conclusion of the test, the final static well data recorded 0.5 hrs after the vacuum had ceased, indicated that all the wells, except SCF-MW-12, were recording substantially high residual vacuums. Static data usually will result in slight well vacuums or pressures. However, residual vacuums of this magnitude (approximately 30% of the highest recorded vacuum during the test period) are quite unusual and may be an indication of the complex lithology at this site.

One possible answer is that the GW mounding was wide spread as indicated in MW-11 which had a GW level decrease of over 1.0 ft. If the induced vacuum had created a GW/LNAPL mound 30 ft in diameter and the induced vacuum is released, the mound will start to seek its static level. When the liquid mounding decreases, it can produce a vacuum within the formation that may be reflected in the outer observation wells. We find the opposite effect in a dual phase Pilot Test where there is a GW depression. The GW will rebound, resulting in recorded pressures on the outer observation wells. These pressures are mostly abated within 0.5 hours.

The GW/LNAPL upwelling and mounding of a substantial distance from the well bore area of the EW and the low vapor well flow, are additional factors that must be considered when projecting an SVE ROI for this site. These factors can result in an ROI error.

The test provided sufficient data for the calculation of a vacuum radius of influence for a specific zone. **The data indicates that the lithology is most likely of anisotropic soil.**

Fuel Use Information

The fuel required for the I-6 engine, at an average of 2,100 rpm and at the h.p. requirement of average test conditions, is 2.98 gals/hr of propane. The estimated (by volume) amount of propane used during the total SVE test time was 11.0 gallons, or 1.47 gals/hr. Therefore, the influent well vapors provided fuel equivalent to 1.51 gals/hr of propane or 50.7%. Based on BTU value, this equates to 1.11 gals of gasoline per hour or 6.99 lb/hr. The well vapors may provide a higher percentage of fuel with increased well flow from additional vapor extraction wells.

Emission Data

HORIBA data during the SVE test indicated the influent vapors had an average hydrocarbon level of 81,811 ppmv. Laboratory analysis of influent vapor samples has indicated that the trend for benzene level is approximately 2.0 % of the TPH. Using a well flow of 5.0 scfm, the calculated emissions from one extraction well are as follows:

HC	=	137	lbs/day	=	5.71 lbs/hr
Benzene	=	2.74	lbs/day	=	0.114 lbs/hr

Although the HORIBA Analyzer has been reasonably accurate compared to laboratory analysis of influent vapors, projections should be based on analytical results from a Certified Testing Laboratory qualified to conduct tests on air emission samples.

Summary & Observations:

- **Test SVE-1:** An average induced vacuum of 72.2"H_2O was required to produce a well flow of 4.81 scfm. The ratio of the vacuum to the well flow is 15:1.
- When the EW induced vacuum was increased, each of the outer wells, with the exception of SCF-MW-12, recorded increased levels of vacuum.
- Due to the high induced vacuum in the EW, the GW upwelling had a significant effect on the available well screen.
- The test provided sufficient data for the calculation and projection of a vacuum radius of influence, (ROI). Figure #1 below, indicated the ROI from the recorded test data.
- During the test period, the influent vapor HC concentrations were steady at approximately 80,000 ppmv; CO_2 remained steady at a low level while O_2 levels were in the range of 11.0 to 12.0% and CO was higher than normal with an average of 5.21%. The sub-surface zone is not considered oxygen deficient.
- **During the test period, the calculated amount of LNAPL consumed as IC engine fuel was 8.32 gals, or 52.4 lbs.**
- **SVE should be an effective method of remediation at this site with an induced vacuum in the 50.0 to 60.0"H_2O range and wells with longer screen intervals.**
- SVE may become less effective if the induced vacuum mounds the GW above the interface area that usually contains the highest concentrations of hydrocarbons. However, in highly permeable zones the SVE induced vacuum will move vertically as well as horizontally.
- **The test provided sufficient data for the calculation and projection of a vacuum ROI.**

Additional Information (this should be read as part of the report):

- Field Operating Data and Notes
- Site Photo Map
- Site Photographs

Conclusion:

Pilot Tests are conducted to provide information on short-term tests that can be projected into long-term remedial plans. These feasibility tests indicated that soil vacuum extraction would be an effective method of remediation for this facility. Although the observed vacuum on some of the outer observation wells was relatively low, the duration of the pilot tests was short compared to continuous operation. **However, the results give positive indication that wells MW-11 & 12, and SCF-MW-7, 11 & 12 were in vacuum communication with the selected SVE extraction well.** The radius of influence defines the region within which the vapor in the vadose zone flows to the extraction well under the influence of a vacuum. The radius of influence depends on soil properties of the vented zone, properties of surrounding soil layers, the depth at which the well is screened, well installation and the presence of any impermeable boundaries such as the water table, clay layers, surface seal, building basements and the presence of such areas as tank pits with backfill and underground utilities. Also, the anisotropic soil conditions must be considered.

Radius of Influence:

Figure #1 indicates that the effective vacuum radius of influence from Test #SVE-1 would be from 31.53 to 35.03 ft, with extraction well flow 5.0 to 5.5 scfm and extraction well vacuum in the 50.0 to 60.0"H_2O range. An approximation of the radius of influence may be obtained by determining the point at which the measured vacuum is **1.0 to 1.3"H_2O. It is assumed that beyond the lower point, the pressure gradient (driving force) is negligible to effectively transport vaporized contaminants to the extraction well**. Under continuous operation, vacuum and radius of influence will most likely continue to increase horizontally and vertically.

The effective radius of influence is based on calculations and equations using a software program of which data was provided from an extensive database collected by AcuVac over a period of years. Each projection is based on the test data and site parameters, and takes into consideration such variables as barometric pressure oscillations and gauge error. Although we cannot provide total assurance of accuracy, past experience and results have proven these projections to be well within the acceptable range of accuracy.

11/7/09	Static Data Time 0755	First Data Time 0800	Second Data Time 0830	Third Data Time 0900	Fourth Data Time 0930	Fifth Data Time 1030	Sixth Data Time 1030
Horiba HC ppm	NA	NA	83,290	NA	86,340	NA	81,190
Horiba CO_2%	NA	NA	2.34	NA	3.18	NA	3.29
Horiba CO%	NA	NA	6.35	NA	5.16	NA	5.03
Horiba O_2%	NA	NA	12.9	NA	13.5	NA	11.2
LEL	NA	NA	207	NA	216	NA	207
Influent Vapor Temp °F	-	68	68	68	68	68	68
Barometric Pressure "Hg	30.28	30.28	30.28	30.28	30.28	30.27	30.27
Extraction Well Flow SCFM Well SVE-9	OFF	8.83	4.97	4.97	4.97	4.97	4.97
Extraction Well Vacuum "H_2O Well SVE-9	OFF	90.0	75.0	75.0	75.0	75.0	75.0
Well MW-11 Vacuum "H_2O Dist. 15.0 ft	.02	.84	26.58	28.70	30.60	31.40	31.72
Well MW-12 Vacuum "H_2O Dist. 23.0 ft	.06	.26	5.11	5.63	5.91	5.98	5.70
Well SCF-MW-11 Vacuum "H_2O Dist. 42.0 ft	.07	.11	1.49	1.83	2.01	2.08	2.16
Well SCF-MW-7 Vacuum "H_2O Dist. 52.0 ft	.05	.10	.63	.63	.63	.62	.62
Well SCF-MW-12 Vacuum "H_2O Dist. 53.0 ft	.01	.02	.42	.27	.09	.06	-(.15)
Groundwater Upwelling - ft	-	6.395	4.498	4.572	4.787	4.898	4.971

-() Indicates Well Pressure

NA - No Data Recorded

11/7/09	Seventh Data Time 1100	Eighth Data Time 1130	Ninth Data Time 1200	Tenth Data Time 1230	Eleventh Data Time 1300	Twelfth Data Time 1330
Horiba HC ppm	**NA**	**72,550**	**NA**	**81,340**	**NA**	**79,400**
Horiba CO_2%	**NA**	**3.29**	**NA**	**4.08**	**NA**	**4.10**
Horiba CO%	**NA**	**3.50**	**NA**	**4.77**	**NA**	**4.47**
Horiba O_2%	**NA**	**11.7**	**NA**	**9.2**	**NA**	**10.1**
LEL	**NA**	**209**	**NA**	**184**	**NA**	**193**
Influent Vapor Temp °F	**68**	**68**	**68**	**68**	**68**	**68**
Barometric Pressure "Hg	**30.28**	**30.28**	**30.28**	**30.24**	**30.24**	**30.22**
Extraction Well Flow SCFM Well SVE-9	**3.92**	**3.92**	**3.92**	**3.92**	**3.92**	**3.92**
Extraction Well Vacuum "H_2O Well SVE-9	**60.0**	**60.0**	**60.0**	**60.0**	**60.0**	**60.0**
Well MW-11 Vacuum "H_2O Dist. 15.0 ft	**28.87**	**29.56**	**29.80**	**30.20**	**30.10**	**30.20**
Well MW-12 Vacuum "H_2O Dist. 23.0 ft	**5.44**	**5.39**	**5.50**	**5.48**	**5.27**	**5.53**
Well SCF-MW-11 Vacuum "H_2O Dist. 42.0 ft	**1.97**	**1.92**	**1.96**	**1.91**	**1.90**	**1.97**
Well SCF-MW-7 Vacuum "H_2O Dist. 52.0 ft	**.54**	**.44**	**.46**	**.42**	**.42**	**.49**
Well SCF-MW-12 Vacuum "H_2O Dist. 53.0 ft	**-(.28)**	**-(.45)**	**-(.53)**	**-(.65)**	**-(.36)**	**-(.63)**
Groundwater Upwelling - ft	**4.098**	**4.123**	**4.267**	**3.850**	**4.334**	**4.309**

-() Indicates Well Pressure

NA - No Data Recorded

11/7/09	Thirteenth Data Time 1400	Fourteenth Data Time 1430	Fifteenth Data Time 1500	Sixteenth Data Time 1530	Static Data Time 1600	Average Data 7.5 Hrs	Maximum Data
Horiba HC ppm	**NA**	**87,190**	**NA**	**83,190**	**NA**	**81,811**	**87,190**
Horiba CO_2%	**NA**	**3.00**	**NA**	**3.28**	**NA**	**3.32**	**6.35**
Horiba CO%	**NA**	**6.80**	**NA**	**5.60**	**NA**	**5.21**	**6.80**
Horiba O_2%	**NA**	**10.9**	**NA**	**12.9**	**NA**	**11.6**	**13.5**
LEL	**NA**	**225**	**NA**	**203**	**NA**	**206**	**225**
Influent Vapor Temp °F	**68**	**68**	**68**	**68**	**NA**	**68**	**68**
Barometric Pressure "Hg	**30.20**	**30.20**	**30.20**	**30.18**	**30.18**	**30.25**	**30.28**
Extraction Well Flow SCFM Well SVE-9	**3.92**	**5.30**	**5.30**	**5.30**	**OFF**	**4.81**	**5.30**
Extraction Well Vacuum "H_2O Well SVE-9	**60.0**	**90.0**	**90.0**	**90.0**	**OFF**	**72.2**	**90.0**
Well MW-11 Vacuum "H_2O Dist. 15.0 ft	**30.30**	**31.92**	**32.00**	**32.75**	**10.66**	**28.47**	**32.75**
Well MW-12 Vacuum "H_2O Dist. 23.0 ft	**5.54**	**5.74**	**5.80**	**5.93**	**1.87**	**5.26**	**5.98**
Well SCF-MW-11 Vacuum "H_2O Dist. 42.0 ft	**1.99**	**2.08**	**2.12**	**2.16**	**1.28**	**1.85**	**2.16**
Well SCF-MW-7 Vacuum "H_2O Dist. 52.0 ft	**.52**	**.53**	**.54**	**.55**	**.19**	**.51**	**.63**
Well SCF-MW-12 Vacuum "H_2O Dist. 53.0 ft	**-(.69)**	**-(.74)**	**-(.67)**	**-(.62)**	**-(.58)**	**-(.31)**	**.42**
Groundwater Upwelling - ft	**4.368**	**5.379**	**5.647**	**6.035**	**.173**	**4.783**	**6.395**

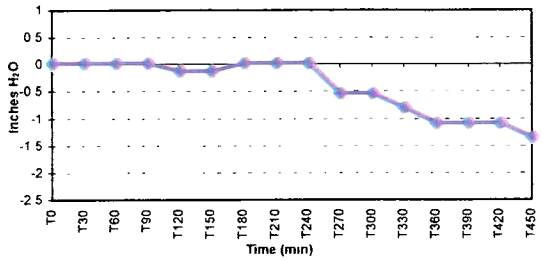
-() Indicates Well Pressure

NA - No Data Recorded

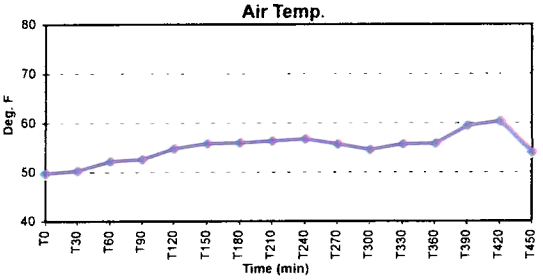
SCHEDULE B
Summary of ACUVAC TEST #SVE-1

Atmospheric Conditions

Barometric Pressure

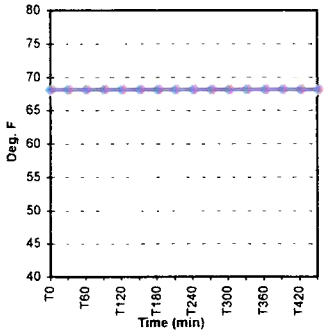


Air Temp.

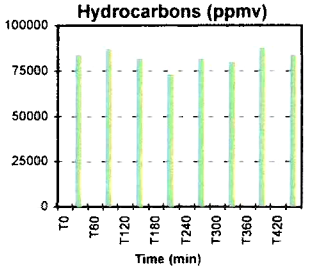


Influent Vapor Data

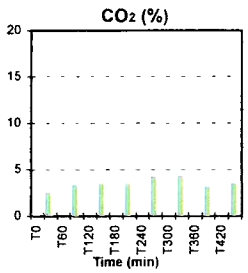
Influent Temp.



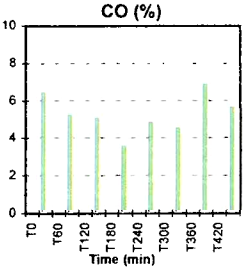
Hydrocarbons (ppmv)



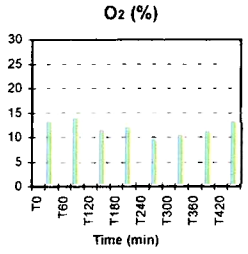
CO_2 (%)



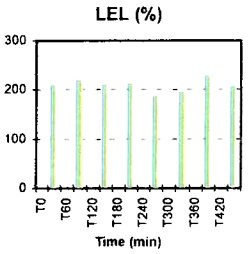
CO (%)



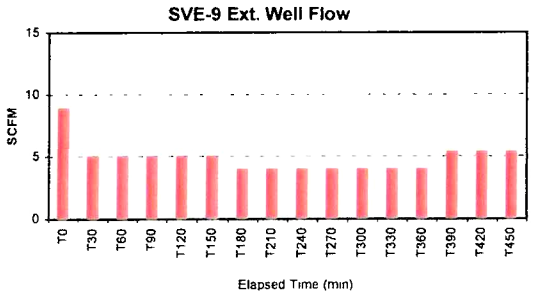
O_2 (%)



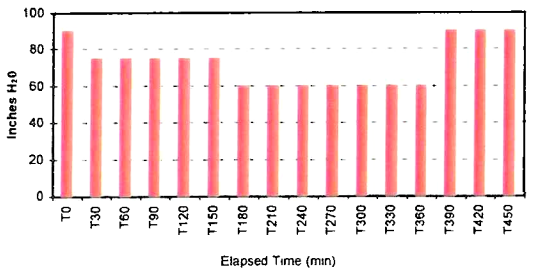
LEL (%)



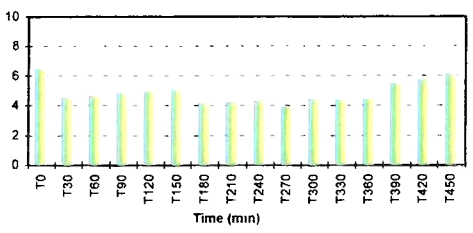
SVE-9 Ext. Well Flow



SVE-9 Ext. Well Vacuum

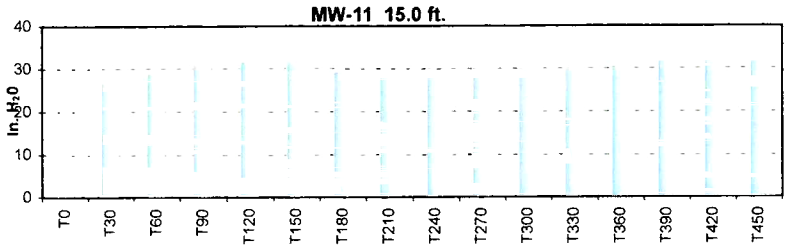


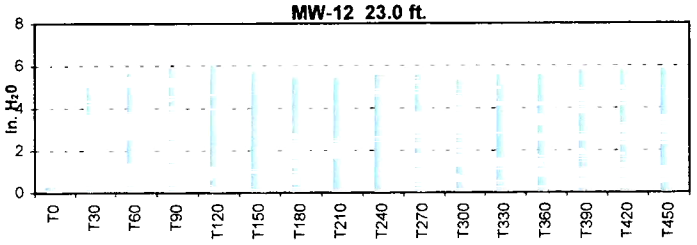
Groundwater Upwelling (feet)

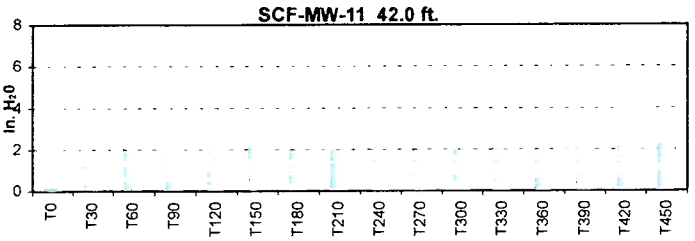


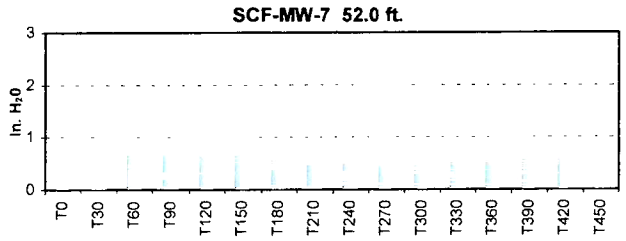
SCHEDULE B
Summary of ACUVAC TEST # SVE-1

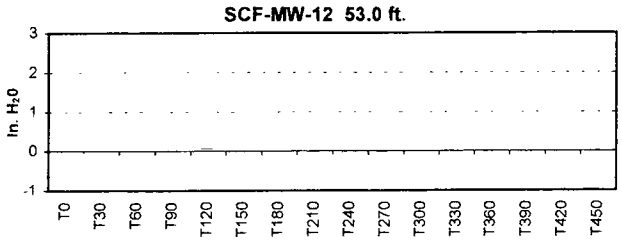
Recorded Well Vacuums and/or Pressures

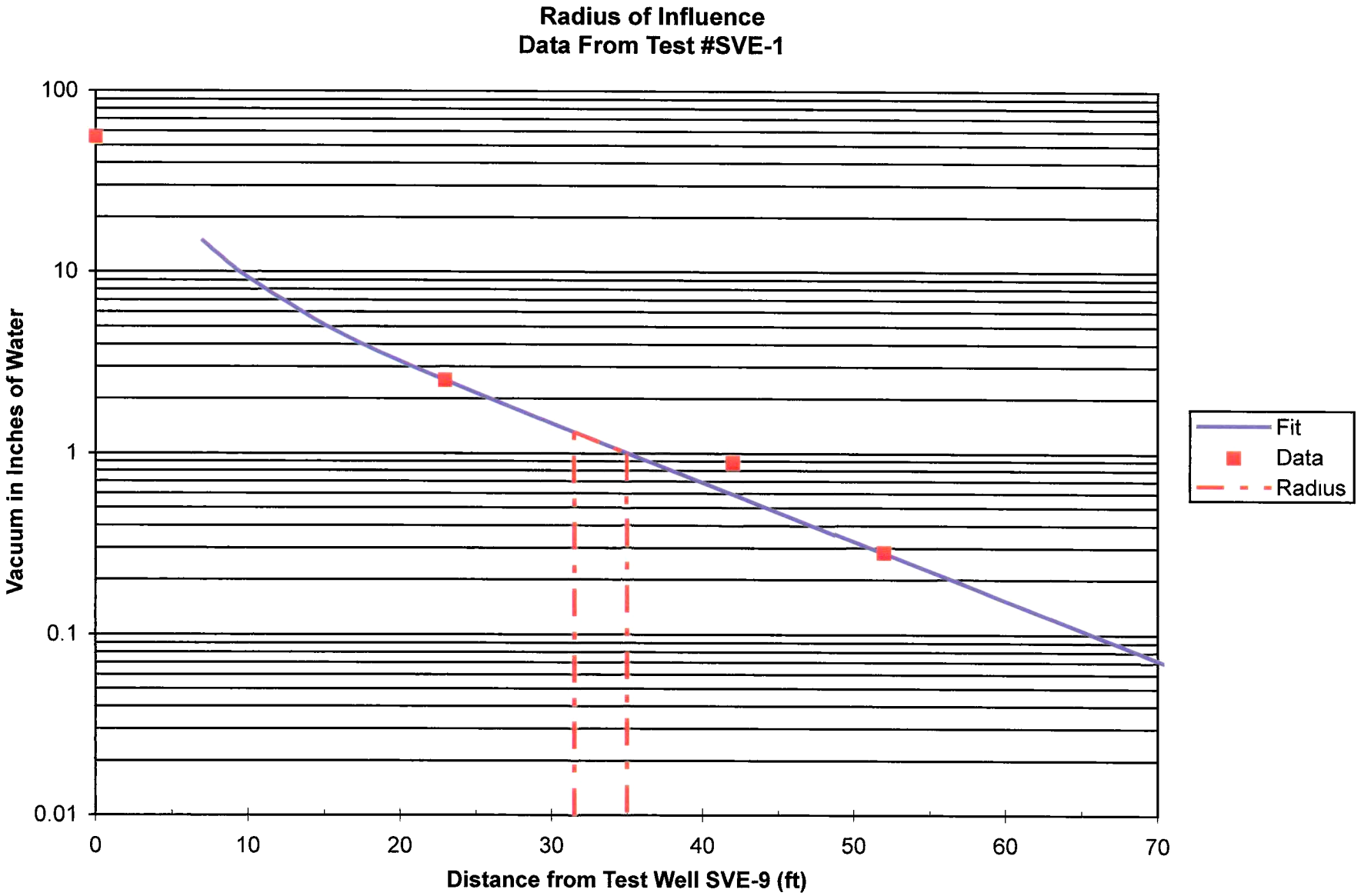











Radius of Influence
Data From Test #SVE-1
Vacuum in Inches of Water
100
10
1
0.1
0.01
0
10
20
30
40
50
60
70
Distance from Test Well SVE-9 (ft)
Fit
Data
Radius

OPERATING DATA - TEST # SVE-1 PAGE # 1 ACUVAC SVE SYSTEM

Location: MONTEZUMA REMEDIATION, SANTA FE, NM Project Engineer: SADLER, LUNDGREN, MATHEWS

		Date:	11.07.09	-	-	-	-	-
		Parameters	Time 0755	Time 0800	Time 0830	Time 0900	Time 0930	Time 1000
		SVE-9	Hr Meter 5004.9	Hr Meter 5005.0	Hr Meter 5005.5	Hr Meter 5006.0	Hr Meter 5006.5	Hr Meter 5007.0
ENGINE/BLOWER		R.P.M.	1,000	2100	2100	2100	2100	2100
		Oil Pressure psi	50	50	50	50	50	50
		Water Temp °F	130	160	160	160	160	160
		Volts	13	13	13	13	13	13
		Intake Vac. "Hg	18	18	15	18	18	18
		Gas Flow Fuel/Propane cfh	90	10	20	20	20	20
ATMOSPHERE/VAPOR/AIR		Dilution Air Flow cfm	-	22	26	26	26	26
		Extraction Well Flow scfm SVE-9	-	8.83	4.97	4.97	4.97	4.97
		Extraction Well Vac. "H_2O SVE-9	-	90.0	75.0	75.0	75.0	75.0
		Influent Vapor Temp. °F	-	68.0	65.0	65.0	65.0	65.0
		Air Temp °F	49.6	49.6	50.1	52.0	52.5	54.6
		Barometric Pressure "Hg	30.28	30.28	30.25	30.28	30.28	30.27
		Absolute Pressure "Hg ELV. 6980	-	22.74	22.74	22.74	22.74	22.73
MONITOR WELL VACUUM	15.0	MW-11 "H_2O	.02	.84	26.58	28.70	30.60	31.40
	23.0	MW-12 "H_2O	.06	.26	5.11	5.63	5.91	5.98
	42.0	SCF MW-11 "H_2O	.07	.11	1.49	1.83	2.01	2.08
	~~40.0~~	~~SVE-5~~ "H_2O	-	-	-	-	-	-
	52.0	SCF MW-7 "H_2O	.05	.10	.63	.63	.63	.62
	53.0	SCF MW-12 "H_2O	.01	.02	.42	.27	.09	.06
		"H_2O						
		"H_2O						
		"H_2O						
		"H_2O						
		"H_2O						
		"H_2O						
MANIFOLD		SVE ON/OFF	OFF	ON	ON	ON	ON	ON
		Data Logger ft	7.253	13.648	11.751	11.825	12.040	12.151
		GW Upwelling ft	-	6.395	4.498	4.572	4.787	4.898
		Extraction Well ~~DTLNAPL~~	25.82					
		Extraction Well DTGW	27.42					

() Indicates Well Pressure LNAPL = 1.60 ft

TEST	Instrument	HORIBA	HORIBA				
	Well #	SVE 9	SVE-9				
	Time	0815	0915				
VAPOR/INFLUENT	HC ppmv	83,290	86,340				
	CO_2 %	2.34	3.18				
	CO %	6.35	5.16				
	O_2 %	12.9	13.5				
	LEL %	207	216				

OPERATING DATA AND NOTES

DATE: 11/07/09 MONTEZUMA REMEDIATION, SANTA FE, NM TEST NO: SVE-1 Page No: 1

0645	Arrived at location, positioned SVE system near Well # SVE-9 as the
	Extraction Well (EW). Opened selected outer wells & gauged DTGW/LNAPL.
	Mobilized SVE equipment, plugged outer wells, installed Data Logger
	in EW. Safety checks, all OK. GW temp. 60.478°F.
0755	Recorded Static data: Recording slight well vacuums from -.01 – -.07.
0800	Start test SVE-1. Initial EW induced vacuum set at 90" H_2O, with
	vapor well flow of 8.83 scfm. GW/LNAPL upwelling near 6 Ft.
0810	Reduced EW vacuum to 75" H_2O, WF @ 4.97 scfm.
	HORIBA Data: HC = 83,290 ppmv, CO_2 = 2.34%, CO = 6.35%, O_2 = 12.9%, LEL = 207%.
0830	Recorded Data: BP — All outer wells recorded increased level of vacuums.
0900	Recorded Data: BP — Wells variable, slight increases, decreases. Note: High Vac. MW-11.
0915	HORIBA Data: HC = 86,340 ppmv ↑, CO_2 = 3.18% ↑, CO = 5.16% ↓, O_2 = 13.5% ↑, LEL 216% ↑
0930	Recorded Data: Outer wells, MW-11 & 12 & SCF-MW-11 increasing, other wells variable.
1000	Recorded Data: BP ↓, EW vacuum steady @ 75.0" H_2O, WF = 4.97 scfm.
	Outer wells MW-11 & 12 & SCF-MW-11 increasing, other wells decreasing.

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OPERATING DATA - TEST # SVE - 1 PAGE # 2 ACUVAC SVE SYSTEM

Location: MONTEZUMA REMEDIATION, SANTE FE, NM Project Engineer: SADLER, LUNDGREN, MATHEWS

	Date:	11.07.04	—	—	—	—	—
	Parameters	Time / Hr Meter	Time / Hr Meter	Time / Hr Meter	Time / Hr Meter	Time / Hr Meter	Time / Hr Meter
	SVE-9	1030 / 5007.5	1100 / 5008.0	1130 / 5008.5	1200 / 5009.0	1230 / 5009.5	1300 / 5010.0
ENGINE/BLOWER	R.P.M.	2100	2100	2100	2100	2100	2100
	Oil Pressure psi	50	50	50	50	50	50
	Water Temp °F	160	160	160	160	160	160
	Volts	13	13	13	13	13	13
	Intake Vac. "Hg	18	18	18	18	18	18
	Gas Flow Fuel/Propane cfh	20	30	30	30	30	30
ATMOSPHERE/VAPOR/AIR	Dilution Air Flow cfm	26	27	27	27	27	27
	Extraction Well Flow SVE-9 scfm	4.91	3.92	3.92	3.92	3.92	3.92
	Extraction Well Vac. SVE-9 "H_2O	75.0	60.0	60.0	60.0	60.0	60.0
	Influent Vapor Temp. °F	68.0	68.0	68.0	65.0	65.0	68.0
	Air Temp °F	55.6	55.8	56.2	56.5	55.5	54.3
	Barometric Pressure "Hg	30.27	30.28	30.28	30.28	30.24	30.24
	Absolute Pressure "Hg	22.73	22.74	22.74	22.74	22.70	22.70
MONITOR WELL VACUUM	MW-11 "H_2O	31.72	28.87	29.56	29.80	30.20	30.10
	MW-12 "H_2O	5.70	5.44	5.39	5.50	5.48	5.27
	SCF-MW-11 "H_2O	2.16	1.97	1.92	1.96	1.91	1.90
	SCF-MW-7 "H_2O	0.62	0.54	0.44	0.46	0.42	0.42
	SCF-MW-12 "H_2O	(0.15)	(0.28)	(0.45)	(0.53)	(0.65)	(0.36)
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
MANIFOLD	SVE ON/OFF	ON	ON	ON	ON	ON	ON
	Data Logger ft	12.224	11.351	11.376	11.520	11.403	11.587
	GW Upwelling ft	4.971	4.098	4.123	4.267	4.150	4.334
	Extraction Well DTLNAPL						
	Extraction Well DTGW						

() Indicates Well Pressure

2.253

TEST							
	Instrument	HORIBA	HORIBA	HORIBA			
	Well #	SVE-9	SVE 9	SVE 9			
	Time	1015	11.15	12.15			
VAPOR/INFLUENT	HC ppmv	81,190	72,550	81,340			
	CO_2 %	3.29	3.29	4.08			
	CO %	5.03	3.50	4.77			
	O_2 %	11.2	11.7	9.2			
	LEL %	207	209	184			

OPERATING DATA AND NOTES

DATE: 11/07/09 MONTEZUMA REMEDIATION, SANTA FE, NM TEST NO: SVE-1 Page No: 2

1015	HORIBA Data: HC = 81,190ppmv↓, CO_2 = 3.29%↑, CO = 5.03%↓, O_2 = 11.2%↓, LEL = 207%↓
1030	Recorded Data: BP –, Wells variable, slight increases, decreases, except
	SCF-MW-12, pressure.
1045	Reduced EW vacuum to 60"H_2O, WF 3.92scfm
1100	Recorded Data: BP↑. Outer wells recording reduced vacuums. SCF-MW-12 pressure
1115	HORIBA Data: HC = 72,550ppmv↓, CO_2 = 3.29%–, CO = 3.50%↓, O_2 = 11.7↑, LEL = 209↑
1130	Recorded Data: BP – Outer wells variable.
1200	Recorded Data: BP – Outer wells recording increased vacuum levels
	except SCF-MW-12, recording a pressure.
1215	HORIBA Data: HC = 81,340ppmv↑, CO_2 = 4.08%↑, CO = 4.77%↑, O_2 = 9.2%↓, LEL = 184↓
1230	Recorded Data: Outer well MW-11 slight increased vacuum. All
	other wells on decreasing vacuum trend.
1300	Vented wells
	Recorded Data: All wells slight decreases.

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OPERATING DATA - TEST # SVE-1 PAGE # 3 ACUVAC SVE SYSTEM

Location: MONTEZUMA REMEDIATION, SANTA FE, NM Project Engineer: SADLER, LUNDGREEN, MATHEWS

	Date:	11.07.09	–	–	–	–	–
	Parameters	Time / Hr Meter	Time / Hr Meter	Time / Hr Meter	Time / Hr Meter	Time / Hr Meter	Time / Hr Meter
	SVE-9	1330 / 5010.5	1400 / 5011.0	1430 / 5011.5	1500 / 5012.0	1530 / 5012.5	1600 / 5013.0
ENGINE/BLOWER	R.P.M.	2100	2100	2100	2100	2100	1000
	Oil Pressure psi	50	50	50	50	50	50
	Water Temp °F	160	160	160	160	160	160
	Volts	13	13	13	13	13	13
	Intake Vac. "Hg	18	18	18	18	18	18
	Gas Flow Fuel/Propane cfh	30	30	0	0	0	40
ATMOSPHERE/VAPOR/AIR	Dilution Air Flow cfm	27	27	25	25	25	12
	Extraction Well Flow scfm SVE-9	3.92	3.92	5.30	5.30	5.30	OFF
	Extraction Well Vac. "H_2O SVE-9	60.0	60.0	90.0	90.0	90.0	OFF
	Influent Vapor Temp. °F	68.0	68.0	68.0	68.0	68.0	N/A
	Air Temp °F	55.5	55.6	59.2	60.1	53.8	52.4
	Barometric Pressure "Hg	30.22	30.20	30.20	30.20	30.18	30.18
	Absolute Pressure "Hg	22.68	22.66	22.66	22.66	22.64	22.64
MONITOR WELL VACUUM	MW-11 "H_2O	30.20	30.30	31.92	32.00	32.75	10.66
	MW-12 "H_2O	5.53	5.54	5.74	5.80	5.93	1.87
	SCF-MW-11 "H_2O	1.99	1.99	2.08	2.12	2.16	1.28
	SCF-MW-7 "H_2O	0.49	0.52	0.53	0.54	0.55	0.19
	SCF-MW-12 "H_2O	(0.63)	(0.69)	(0.74)	(0.67)	(0.62)	(0.53)
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
	"H_2O						
MANIFOLD	SVE ON/OFF	ON	ON	ON	ON	ON	OFF
	Data Logger ft	11.562	11.621	12.632	12.900	13.255	7.496
	GW Upwelling ft	4.309	4.368	5.379	5.647	6.035	0.173
	Extraction Well DTLNAPL					22.85	
	Extraction Well DTGW					26.25	

() Indicates Well Pressure

LNAPL 3.40'

TEST	Instrument	HORIBA	HORIBA	HORIBA			
	Well #	SVE-9	SVE-9	SVE-9			
	Time	1315	1415	1515			
VAPOR/INFLUENT	HC ppmv	79,400	87,190	83,190			
	CO_2 %	4.10	3.00	3.28			
	CO %	4.47	6.80	5.60			
	O_2 %	10.1	10.9	12.9			
	LEL %	193	225	203			

OPERATING DATA AND NOTES

DATE: 11/07/09 MONTEZUMA REMEDIATION, SANTA FE, NM TEST NO: SVE-1 Page No: 3

1315	HORIBA DATA: HC = 79,400ppmv↓, CO_2 = 4.10%↑, CO = 4.47%↓, O_2 = 10.1%↑, LEL = 193%↑
1330	Recorded Data: BP↓↓ All outer wells recording increased vacuum
	trend, except SCF-MW-12 which is recording a pressure.
1400	Recorded Data: BP↓↓ All outer wells on slight increasing trend,
	except SCF-MW-12, pressure.
1415	HORIBA DATA: HC = 87,190ppmv↑, CO_2 = 3.00%↓, CO = 6.80%↑, O_2 = 10.9%↑, LEL = 225%↑
1430	Recorded Data: BP — All outer wells, except SCF-MW-12, on increasing trend.
1500	Increased EW vacuum to 90"H_2O, WF of 5.30 scfm. Recorded Data: BP — All outer wells, except SCF-MW-12, on increasing vacuum
	trend.
1515	HORIBA Data: HC = 83,190ppmv↓, CO_2 = 3.28%↑, CO = 5.60%↓, O_2 = 12.9%↑
	LEL = 203%↓
1530	Recorded Data: BP↓↓ All outer wells on increasing vacuum trend.
---	Discontinued SVE test to allow wells to adjust to atmospheric
	conditions.
1600	All wells still recording a residual vacuum.
1700	Secured all wells. Departed site.

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Test # SVE-2

Well Data Information:

TABLE #2 - TEST #SVE-2

WELL NO.		SVE-5	MW-6	MW-5	CMW-5	SVE-1	CMW-4	MW-7	SVE-4	SVE-2	CMW-6	EW/ GWUP [2]	EW/ WF [3]	EW/ VAC [4]
TD	ft	40.0	40.0	41.0	44.0	39.0	33.0	40.0	27.0	39.2	29.0	-	-	-
Screen	ft	15.0-40.0	25.0-40.0	26.0-41.0	24.0-44.0	14.0-39.0	18.0-33.0	25.0-40.0	12.0-27.0	14.2-39.2	14.0-29.0	-	-	-
Well size	in	4.0	2.0	2.0	2.0	4.0	4.0	2.0	4.0	4.0	2.0	-	-	-
DTGW - 0725 Hrs - Static	ft	30.40	30.36	31.07	33.97	30.01	21.00	31.40	21.07	28.52	17.77	-	-	-
DTGW - Hydro Equivalent	ft	30.40	30.32	31.07	33.97	29.57	21.00	31.4	21.07	28.52	17.77	-	-	-
DTLNAPL - 0725 Hrs - Static	ft	30.38	30.31	-	-	29.44	-	-	-	-	-	-	-	-
LNAPL- 0725 Hrs - Static	ft	0.02	0.05	-	-	0.57	-	-	-	-	-	-	-	-
Data Logger - 0725 Hrs - Static	ft	4.725	-	-	-	-	-	-	-	-	-	0	0	0
Data Logger - 0730 Hrs - Start SVE	ft	5.094	-	-	-	-	-	-	-	-	-	0.369	17.73	15.0
Data Logger - 0800 Hrs	ft	5.176	-	-	-	-	-	-	-	-	-	0.451	17.73	15.0
Data Logger - 0830 Hrs	ft	5.424	-	-	-	-	-	-	-	-	-	0.699	24.38	20.0
Data Logger - 0900 Hrs	ft	5.468	-	-	-	-	-	-	-	-	-	0.743	24.38	20.0
Data Logger - 0930 Hrs	ft	5.498	-	-	-	-	-	-	-	-	-	0.773	25.35	20.0
Data Logger - 1000 Hrs	ft	5.564	-	-	-	-	-	-	-	-	-	0.839	25.35	20.0
Data Logger - 1030 Hrs	ft	5.677	-	-	-	-	-	-	-	-	-	0.952	31.01	25.0
Data Logger - 1100 Hrs	ft	5.755	-	-	-	-	-	-	-	-	-	1.030	31.01	25.0
Data Logger - 1130 Hrs	ft	5.780	-	-	-	-	-	-	-	-	-	1.055	32.07	25.0
Data Logger - 1200 Hrs	ft	5.792	-	-	-	-	-	-	-	-	-	1.067	33.21	25.0
Data Logger - 1230 Hrs	ft	5.875	-	-	-	-	-	-	-	-	-	1.150	34.41	25.0
Data Logger - 1300 Hrs	ft	5.917	-	-	-	-	-	-	-	-	-	1.192	36.37	25.0
Data Logger - 1330 Hrs	ft	6.059	-	-	-	-	-	-	-	-	-	1.334	46.85	30.0
Data Logger - 1400 Hrs	ft	6.086	-	-	-	-	-	-	-	-	-	1.361	51.04	30.0
Data Logger - 1430 Hrs	ft	6.275	-	-	-	-	-	-	-	-	-	1.550	58.32	35.0
Data Logger - 1500 Hrs - Stop SVE	ft	6.309	-	-	-	-	-	-	-	-	-	1.665	60.38	35.0
Data Logger - 1530 Hrs - Static	ft	4.838	-	-	-	-	-	-	-	-	-	0.113	0	0
DTGW - 1500 Hrs	ft	28.66	30.58	31.11	30.52	30.03	DRY	31.41	21.07	28.54	17.82	-	-	-
DTGW - Hydro Equivalent	ft	28.59	30.45	31.11	30.52	29.61	-	13.41	21.07	28.54	17.82	-	-	-
DTLNAPL - 1500 Hrs	ft	28.56	30.40	-	-	29.46	-	-	-	-	-	-	-	-
LNAPL- 1500 Hrs	ft	0.10	0.18	-	-	0.57	-	-	-	-	-	-	-	-
GW Level Decreases (+)/Increases (-) Based on Hydro Equivalent	ft	+1.057 [1]	-(0.13)	-(0.04)	+0.45	+0.04	-	-(0.01)	-	-(0.02)	-(0.05)	-	-	-
Distance from SVE-5	ft	0	22.0	30.0	57.0	59.0	65.0	81.0	101.0	104.0	115.0	-	-	-

1. Average GW upwelling/FT
2. GW/LNAPL upwelling during test period/FT
3. SVE Well Flow - scfm
4. SVE Induced Vacuum/"H_2O

Note: (a) Specific Gravity = 0.74

(b) The liquid upwelling is greater than the recorded data due to the difference in specific gravity of LNAPL and GW. The data logger is set for a specific gravity of 1.0.

TEST SVE-2: Well # SVE-5

Discussion of Data: - Test SVE-2

Test #SVE-2 was an 8.0 hour SVE test, including the time for static well data, conducted from well SVE-5 as the vapor extraction well (EW). **The LNAPL thickness in EW was 0.02 ft**. Static well data indicated that the selected outer monitoring wells were recording slight vacuums ranging from 0.01 to 0.07"H_2O with the exception of CMW-5 which recorded a well pressure. The barometric pressure was steady at 30.19"Hg and the ambient air temperature was 42.1°F. **At the start of this 0.5 hour test period, the EW vacuum was 15.0"H_2O**, with a flow of 17.73 scfm and the influent vapor temperature was 63°F. Outer wells MW-5 & 6, which are located within 30.0 ft from the EW, recorded an increasing vacuum trend. The other 6 wells, SVE-1, 2 & 4, MW-7 and CMW-4 & 6, recorded a slight increase of 0.01 to 0.03"H_2O. Barometric pressure oscillation can cause increases/decreases in the 0.01 to 0.06"H_2O range. During this test period, the average recorded GW/LNAPL upwelling was 0.37 ft. The upwelling had a minimal effect on the available well screen. The GW temperature was recorded at 56.335°F.

The HORIBA Emission Analytical instrument is an accurate field instrument that will record TPH levels up to 100,000 ppmv and CO_2 levels up to 25%. During this initial test period, the HORIBA analytical data indicated the single influent vapor sample taken from the EW had hydrocarbon concentrations (HC) of 13,240 ppmv, with CO_2 at 7.46%, CO at 0.03%, O_2 levels of 9.5% and LEL of 55%. The propane flow was recorded at 140 cfh, with a well flow of 17.73 scfm.

After 0.5 hours of steady induced vacuum, **the EW vacuum was increased to 20.0"H_2O**, with a flow of 24.38 scfm, increasing to 25.35 scfm. This test period was 2.0 hours. The outer wells initially recorded an increasing vacuum trend in response to the increased induced vacuum and then remained mostly steady with slight increases and decreases. The barometric pressure increased from 30.20 to 30.25"Hg during this test period. The slight increases in the most distant wells are an example of how barometric pressure oscillations affect monitoring well vacuums or pressures. The influent vapor temperature remained constant at 63°F and the ambient air temperature increased to 50.9°F. The average GW upwelling was 0.88 ft above static level.

Generally, a decreasing barometric pressure results in increased well pressures (decreased vacuums) on those wells plugged and sealed at the TOC, while an increasing barometric pressure results in increased well vacuums. **There are many variables that can affect Pilot Test data, but barometric pressure oscillations have the most immediate and profound effect.**

HORIBA analytical data indicated the two influent vapor samples taken from the EW during this test period had HC of 8,940 and 6,480 ppmv, with CO_2 at 7.14 and 5.98%, CO levels at 0%, O_2 levels of 10.3 and 12.3% and LEL of 45 and 33%. The propane flow was recorded at 140 cfh, with a well flow of 25.35 scfm.

After 2.0 hours of steady vacuum of 20.0"H_2O, the induced vacuum was increased to 25.0"H_2O, with a well flow of 31.01 scfm, increasing to 36.37 scfm over the test period, with the induced vacuum remaining constant. The test period was 3.0 hours. The barometric pressure was on a decreasing trend from 30.25 to 30.20"Hg. The ambient air temperature increased to 66.9°F and the influent vapor temperature was steady at 63°F. Outer wells MW-5 & 6, SVE-1 and CMW-4 recorded an increasing vacuum trend in response to the EW vacuum increase and after 2.5 hrs developed a decreasing trend when the barometric pressure decreased. The GW upwelling averaged 1.07 ft above static level. The GW upwelling had a minimal effect on the available screen.

Additional HORIBA analytical data indicated the three influent vapor samples taken from the EW, had HC concentrations of 5,170, 4,130 and 4,240 ppmv, CO_2 at 6.20, 5.04 and 5.24%, CO levels at 0%, O_2 levels of 13.4, 14.4 and 14.4% and LEL levels of 30, 25 and 26%. The propane flow was recorded at 150 cfh, with a well flow in the 31 to 35 scfm range.

After 3.0 hours of steady vacuum of 25.0"H_2O, the induced vacuum was increased to 30.0"H_2O, with a well flow of 46.85 scfm, increasing to 51.04 scfm, with the EW vacuum remaining steady. The test period was 1.0 hour. The barometric pressure continued on a decreasing trend to 30.19"Hg. The influent vapor temperature was steady at 63°F and the ambient temperature decreased to 64.3°F. The outer wells, MW-5 & 6, recorded an increasing vacuum trend in response to the EW vacuum increase. The other wells were variable with slight increases and decreases. The GW upwelling averaged 1.35 ft above static level.

HORIBA analytical data indicated the single influent vapor sample taken during this test period had HC concentrations of 3,760 ppmv, CO_2 at 5.14%, CO at 0%, an O_2 level of 16.8% and LEL of 21%. The propane flow was recorded at 150 cfh, with a well flow of 50 scfm.

During the last 1.0 hour of the test, the EW vacuum was increased to 35.0"H_2O, with a vapor well flow of 58.32 scfm, increasing to 60.38 scfm, with the EW vacuum remaining steady. The outer wells continued to record an increasing vacuum trend. The barometric pressure decreased from 30.19 to 30.18"Hg. The influent vapor temperature was steady at 63°F and the ambient temperature decreased to 59.2°F. The average GW upwelling was 1.61 ft above static level. After the induced vacuum ceased, the static well data was recorded 0.5 hours later. Each of the outer wells recorded well pressures ranging from 0.01 to 0.46"H_2O. There were only minor differences between the beginning and ending static well data. **During the 7.5 hour test period, the static LNAPL level increased from 0.02 to 0.10 ft.**

The final HORIBA analytical data indicated the influent vapors had HC levels of 3,060 ppmv, CO_2 at 5.72%, CO at 0%, an O_2 level of 15.2% and LEL of 18%.

The test provided sufficient data for the calculation of a vacuum radius of influence for a specific zone. SVE short-circuiting was most likely a factor in limiting the SVE ROI. An indication of SVE short-circuiting is the continuing increase in vapor well flow when the induced vacuum remains steady.

Emission Data

HORIBA data during the SVE test indicated the influent vapors had an average hydrocarbon level of 7,033 ppmv. Laboratory analysis of influent vapor samples has indicated that the trend for benzene level is approximately 2.0 % of the TPH. Using a well flow of 40 scfm, the calculated emissions from one extraction well are as follows:

HC	=	92	lbs/day	=	3.83	lbs/hr
Benzene	=	1.84	lbs/day	=	0.077	lbs/hr

During the test period, the calculated amount of LNAPL consumed as IC engine fuel was 4.58 gals or 28.82 lbs.

Although the HORIBA Analyzer has been reasonably accurate compared to laboratory analysis of influent vapors, projections should be based on analytical results from a Certified Testing Laboratory qualified to conduct tests on air emission samples.

Barometric and Absolute Pressure:

The barometric pressure and change in barometric pressure during the SVE test period is read directly from **two** aircraft altimeters that have been tested and certified to 20,000 ft above sea level. The tests and certification were conducted by an FAA approved aircraft instrument company. During the SVE Pilot Test, the altimeters were set and held constant at an elevation of 6,980 ft. The corresponding barometric pressure is read directly from the altimeter.

The absolute pressure was calculated based on certified data obtained from the tests of the two altimeters. Between 0 ft (sea level) and 10,000 ft, the pressure differential per 1,000 ft is 36.570 mbar which equates to approximately 1.08"Hg. These two altimeters have actually been checked at each 1,000 ft interval and certified correct.

SCFM Calculations

To convert ACFM to SCFM, the following equation was used during the SVE Pilot Test:

$$SCFM = ACFM \sqrt{\frac{(14.7 \pm PSIG) \times 520}{14.7 \quad 480 + {}^{\circ}FO}}$$

Where: $PSIG = \frac{"H_2O}{27.71}$

And: $^{\circ}FO$ = Observed temperature in $^{\circ}F$

Summary & Observations:

- **Test SVE-1:** An average induced vacuum of 21.7"H_2O was required to produce a well flow of 34.35 scfm. The ratio of the vacuum to the well flow is 0.63:1.

- The average flow per foot of screen was 2.40 scfm.
- When the EW induced vacuum was increased, wells MW-5 & 6 were the primary wells recording increased levels of vacuum. The other wells recorded slight increases or decreases.
- When the induced vacuum in the EW was increased, the vapor well flow increased a proportional amount. However, during the test period, the vacuum remained constant and the well flow continued on an increasing trend. The continued well flow increase was most likely the result of SVE short-circuiting which creates preferential flow paths.
- Due to the low induced vacuum in the EW, the GW upwelling had a minimal effect on the available well screen.
- The suspected area for the SVE short-circuiting was the one or more underground utilities which appear to be within 5 to 6 ft of SVE-5.
- Additional indicators of SVE short-circuiting were the increasing O_2 levels and the decreasing TPH levels. O_2 increased from a low of 9.5% to a high of 16.8% while the TPH levels decreased from 13,240 ppmv to 3,060 ppmv.
- The test provided minimal data for the calculation and projection of a vacuum radius of influence, (ROI). Figure #2 below, indicated the ROI from the recorded test data.
- **SVE will most likely be an effective method of remediation at this site if the EW wells are located in an area that would provide minimal SVE short-circuiting.**

Additional Information (this should be read as part of the report):

- Field Operating Data and Notes
- Site Photo Map
- Site Photographs

Conclusion:

Pilot Tests are conducted to provide information on short-term tests that can be projected into long-term remedial plans. These feasibility tests indicated that soil vacuum extraction may be an effective method of remediation for this facility. Although the observed vacuum on some of the outer observation wells was relatively low, the duration of the pilot tests was short compared to continuous operation. **However, the results give positive indication that wells MW-5 & 6 and SVE-1 were in vacuum communication with the selected SVE extraction well.** The radius of influence defines the region within which the vapor in the vadose zone flows to the extraction well under the influence of a vacuum. The radius of influence depends on soil properties of the vented zone, properties of surrounding soil layers, the depth at which the well is screened, well installation and the presence of any impermeable boundaries such as the water table, clay layers, surface seal, building basements and the presence of such areas as tank pits with backfill and underground utilities.

Radius of Influence:

Figure #2 indicates that the effective vacuum radius of influence from Test #SVE-2 (well SVE-5) would be from 34.18 to 38.03 ft, with extraction well flow of 45.0 to 50.0 scfm and extraction well vacuum in the 30.0 to 35.0"H_2O range. An approximation of the radius of influence may be obtained by determining the point at which the measured vacuum is **0.30 to 0.35"H_2O. It is assumed that beyond**

the lower point, the pressure gradient (driving force) is negligible to effectively transport vaporized contaminants to the extraction well. Under continuous operation, vacuum and radius of influence will most likely continue to increase horizontally and vertically.

The effective radius of influence is based on calculations and equations using a software program of which data was provided from an extensive database collected by AcuVac over a period of years. Each projection is based on the test data and site parameters, and takes into consideration such variables as barometric pressure oscillations and gauge error. Although we cannot provide total assurance of accuracy, past experience and results have proven these projections to be well within the acceptable range of accuracy.

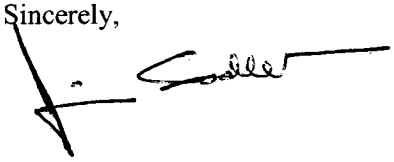
To calculate SVE and well placement, the equation we use is as follows:

$L = 2\ ROI\ Cos\ 30^{o}$; L = distance between wells; ROI = Radius of influence

All other data, including the groundwater depth, well placement, extraction well screened intervals, air injection pressure and flow and SVE recovery rate, must be considered in the final design for a corrective action plan (CAP).

We appreciate the opportunity to have worked with you and Tom on this project. We wish the test results would have been more definitive but we can only report what we record. Once you have reviewed the report, please advise me if you have any questions.

Sincerely,



James E. Sadler
Engineer/Environmental

290079 REP

Attachment A

Acronyms and Definitions

A	Annulus - the space between the pipes and lines in the extraction well and the outer casing
AI (AS)	Air Injection (Sparging) the mass transfer of O_2 from air to groundwater
BGL	Below Ground Level
BGS	Below Ground Surface
BP	Barometric Pressure (Atmospheric Pressure)
BTOC	Below Top of Casing
CFH	Cubic Feet Per Hour
CFM	Cubic Feet Per Minute
DNAPL	Dense Non-Aqueous Petroleum Liquid
DPVE	Dual Phase Vacuum Extraction
DTGW	Depth to Groundwater
DTPSH	Depth to Phase Separated Hydrocarbons/LNAPL
DT	Drop Tube
EVR	Enhanced Vacuum Recovery, (SVE with air injection into the EW below the liquid level)
EW	Extraction Well
GW	Groundwater
GWD	Groundwater Depression
GWE	Groundwater Extraction
GWUP	Groundwater Upwelling
HC	Hydrocarbon (Petroleum)
"H_2O	Inches of Water
"Hg	Inches of Mercury
IHG	Induced Hydraulic Gradient
IV	Induced Vacuum, normally from a vacuum pump connected to the extraction well or vapor recovery well
LEL	Lower Explosive Limit
LNAPL	Light Non-Aqueous Petroleum Liquid
MDP	Mobil Dual Phase
P	Pressure, the existence of above atmospheric pressure
PSH	Phase Separated Hydrocarbons
ROI	Radius of Influence
RPM	Revolutions per Minute
SCFM	Standard Cubic Feet per Minute
SVE	Soil Vacuum Extraction
TD	Total Depth
QT	Quick Test, a short duration SVE Test
V	Vacuum, the existence of below atmospheric pressure
VEGE	Vacuum Enhanced Groundwater Extraction
VER	Vacuum Enhanced Recovery
VEW	Vapor Extraction Well

SCHEDULE C

MONTEZUMA REMEDIATION
SANTA FE, NM
Test #SVE-2, Pg 1

AcuVac Remediation Inc.

11/8/09	Static Data Time 0725	First Data Time 0730	Second Data Time 0800	Third Data Time 0830	Fourth Data Time 0900	Fifth Data Time 0930	Sixth Data Time 1000
Horiba HC ppm	NA	13,240	NA	8,940	NA	6,480	NA
Horiba CO_2%	NA	7.46	NA	7 14	NA	5.98	NA
Horiba CO%	NA	0.03	NA	0	NA	0	NA
Horiba O_2%	NA	9.5	NA	10.3	NA	12.3	NA
LEL	NA	55	NA	45	NA	33	NA
Influent Vapor Temp °F	NA	63	63	63	63	63	63
Barometric Pressure "Hg	30.19	30.19	30.20	30.21	30.21	30.24	30.25
Extraction Well Flow SCFM Well SVE-5	OFF	17 73	17 73	24.38	24.38	25.35	25.35
Extraction Well Vacuum "H_2O Well SVE-5	OFF	15.0	15.0	20.0	20.0	20.0	20.0
Well MW-6 Vacuum "H_2O Dist. 22.0 ft	.03	19	18	.28	.31	.32	.29
Well MW-5 Vacuum "H_2O Dist. 30.0 ft	.01	.15	19	.31	.29	.32	.31
Well CMW-5 Vacuum "H_2O Dist. 57.0 ft	-(.22)	-(2.90)	-(3.85)	-(3.21)	-(2.90)	-(2.47)	-(2.29)
Well SVE-1 Vacuum "H_2O Dist. 59.0 ft	.01	.03	.05	.09	.06	.07	.06
Well CMW-4 Vacuum "H_2O Dist. 65.0 ft	.01	.03	.03	.06	.06	.03	.03
Well MW 7 Vacuum "H_2O Dist. 81.0 ft	.01	.01	.01	.07	.03	.06	.03
Well SVE-4 Vacuum "H_2O Dist. 101.0 ft	.01	.02	.02	.03	.03	.03	.05
Well SVE-2 Vacuum "H_2O Dist. 104.0 ft	.01	.02	.02	.03	.02	.03	.03
Well CMW-6 Vacuum "H_2O Dist. 115.0 ft	.01	.03	.02	.03	.03	.03	.02
Groundwater Upwelling ft	-	.369	.451	.699	.742	.773	.839

( ) Indicates Well Pressure

NA - No Data Recorded

11/8/09	Seventh Data Time 1030	Eighth Data Time 1100	Ninth Data Time 1130	Tenth Data Time 1200	Eleventh Data Time 1230	Twelfth Data Time 1300	Thirteenth Data Time 1330
Horiba HC ppm	5,170	NA	4,130	NA	4,240	NA	3,760
Horiba CO_2%	6.20	NA	5.04	NA	5.24	NA	5.14
Horiba CO%	0.01	NA	0	NA	0	NA	0
Horiba O_2%	13.4	NA	14.4	NA	14.7	NA	16.8
LEL	30	NA	25	NA	26	NA	21
Influent Vapor Temp °F	63	63	63	63	63	63	63
Barometric Pressure "Hg	30.25	30.24	30.22	30.22	30.21	30.20	30.19
Extraction Well Flow SCFM Well SVE-5	31.01	31.01	31.01	32.07	33.21	34.41	46.85
Extraction Well Vacuum "H_2O Well SVE-5	25.0	25.0	25.0	25.0	25.0	25.0	30.0
Well MW-6 Vacuum "H_2O Dist. 22 0 ft	.35	.36	.36	.35	.41	.39	.44
Well MW-5 Vacuum "H_2O Dist. 30.0 ft	.35	.35	.35	.33	.40	.38	.44
Well CMW-5 Vacuum "H_2O Dist. 57.0 ft	-(2.17)	-(2.13)	-(2.10)	-(2.07)	-(1.95)	-(1.87)	-(1.86)
Well SVE-1 Vacuum "H_2O Dist. 59.0 ft	.06	.09	.09	.07	.09	11	11
Well CMW-4 Vacuum "H_2O Dist 65.0 ft	.06	.05	.03	.05	.05	.07	.03
Well MW 7 Vacuum "H_2O Dist. 81.0 ft	.03	.02	.02	.01	.05	.03	.05
Well SVE-4 Vacuum "H_2O Dist 101.0 ft	.05	.02	.02	.03	.01	.02	.01
Well SVE-2 Vacuum "H_2O Dist. 104.0 ft	.02	.02	.01	.03	.02	.03	.03
Well CMW-6 Vacuum "H_2O Dist. 115.0 ft	.02	.05	.02	.03	.03	.02	.01
Groundwater Upwelling ft	.952	1.030	1.055	1.067	1 150	1 192	1.334

( ) Indicates Well Pressure

NA - No Data Recorded

11/8/09	Fourteenth Data Time 1400	Fifteenth Data Time 1430	Sixteenth Data Time 1500	Static Data Time 1530	Average Data 7.5 Hrs	Maximum Data
Horiba HC ppm	NA	3,060	NA	NA	6,128	13,240
Horiba CO_2%	NA	5.72	NA	NA	5.99	7.46
Horiba CO%	NA	0	NA	NA	0.01	0.03
Horiba O_2%	NA	15.2	NA	NA	13.3	16.8
LEL	NA	18	NA	NA	32	55
Influent Vapor Temp °F	63	63	63	NA	63	63
Barometric Pressure "Hg	30.19	30.18	30.18	30.19	30.21	30.25
Extraction Well Flow SCFM Well SVE-5	51.04	58.32	60.38	OFF	34.01	60.38
Extraction Well Vacuum "H_2O Well SVE-5	30.0	35.0	35.0	OFF	24.4	35.0
Well MW-6 Vacuum "H_2O Dist. 22.0 ft	.49	.58	.57	-(.01)	.37	.57
Well MW-5 Vacuum "H_2O Dist. 30.0 ft	.42	.52	.50	-(.01)	.35	.52
Well CMW-5 Vacuum "H_2O Dist. 57.0 ft	-(1.74)	-(1.61)	-(1.46)	-(.46)	-(2.29)	-(.22)
Well SVE-1 Vacuum "H_2O Dist. 59.0 ft	10	13	14	-(.01)	.08	14
Well CMW-4 Vacuum "H_2O Dist. 65.0 ft	.06	.09	10	0	.05	10
Well MW 7 Vacuum "H_2O Dist. 81.0 ft	.06	.05	.05	0	.04	.07
Well SVE-4 Vacuum "H_2O Dist. 101.0 ft	.03	.03	.06	-(.01)	.03	.06
Well SVE-2 Vacuum "H_2O Dist. 104.0 ft	.02	.02	.03	-(.01)	.02	.03
Well CMW-6 Vacuum "H_2O Dist. 115.0 ft	.03	.05	.03	-(.01)	.03	.05
Groundwater Upwelling ft	1.361	1.550	1.665	-	1.014	1.665

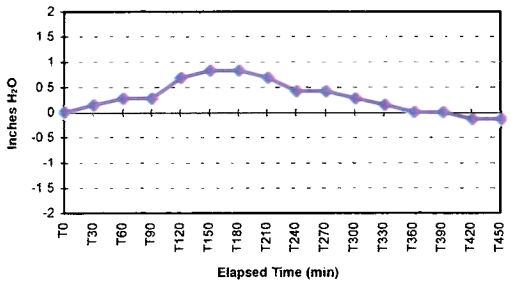
( ) Indicates Well Pressure

NA No Data Recorded

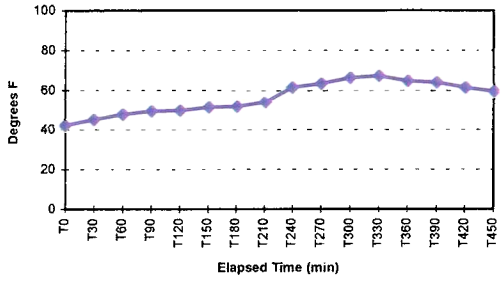
SCHEDULE D
Summary of ACUVAC TEST # SVE-2

Atmospheric Conditions

Barometric Pressure Change

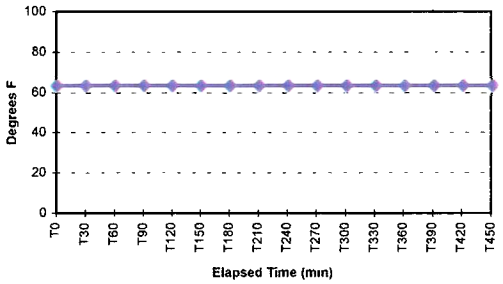


Air Temperature Change

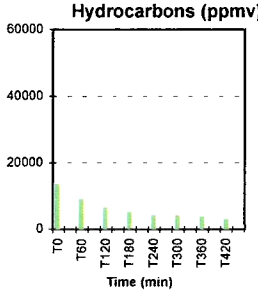


Influent Vapor Data

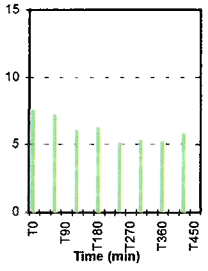
Influent Temperature Change



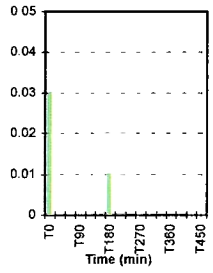
Hydrocarbons (ppmv)



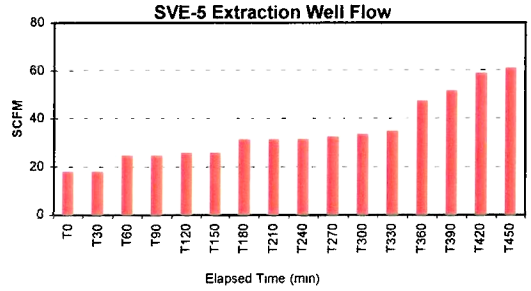
CO2 (%)



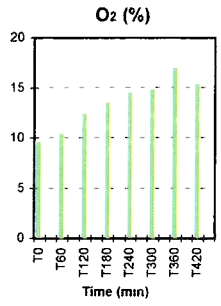
CO (%)



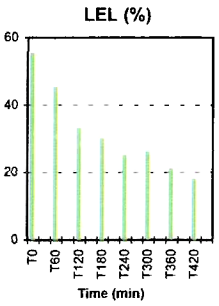
SVE-5 Extraction Well Flow



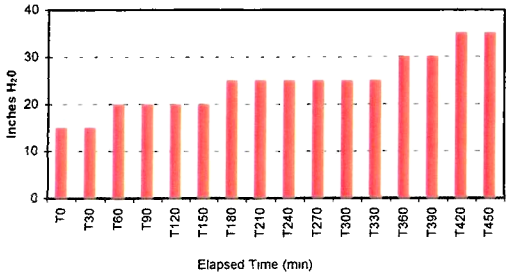
O2 (%)



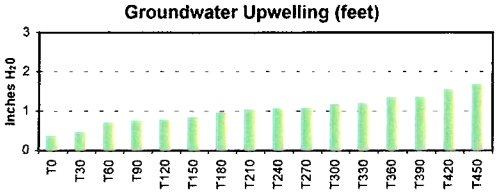
LEL (%)



SVE-5 Extraction Well Vacuum



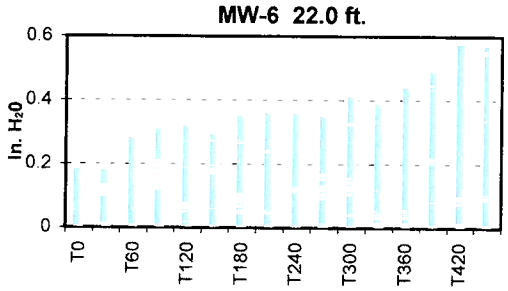
Groundwater Upwelling (feet)

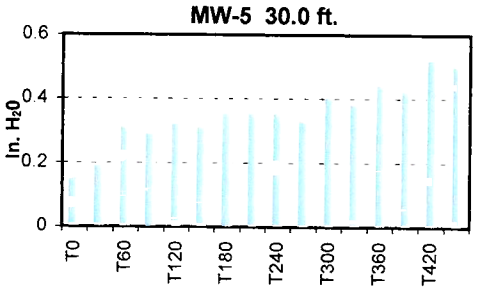


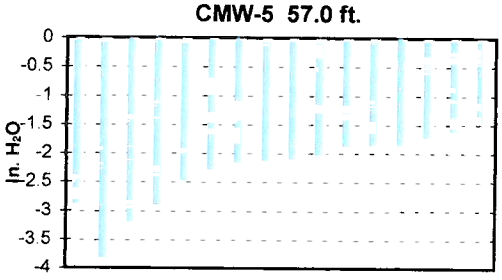
SCHEDULE D
Summary of ACUVAC TEST #SVE-2

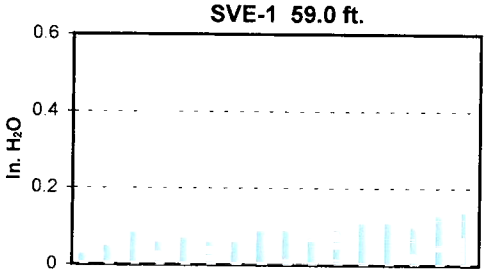
MONTEZUMA REMEDIATION
SANTA FE, NM
November 8, 2009

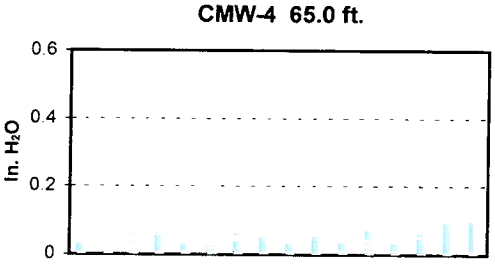
Recorded Well Vacuums and/or Pressures

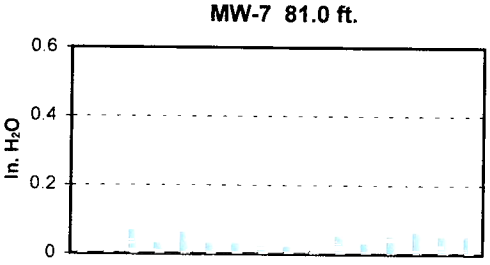


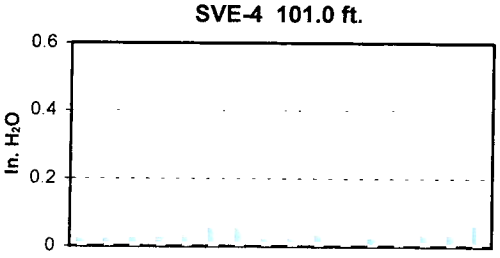


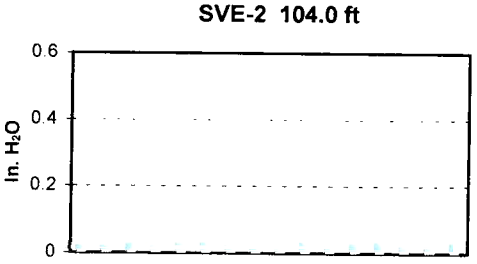


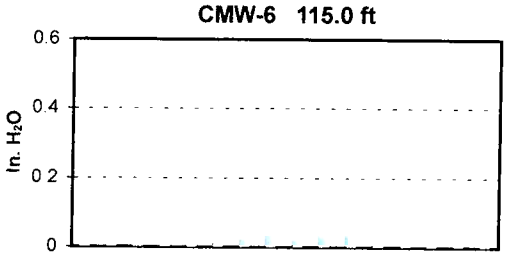


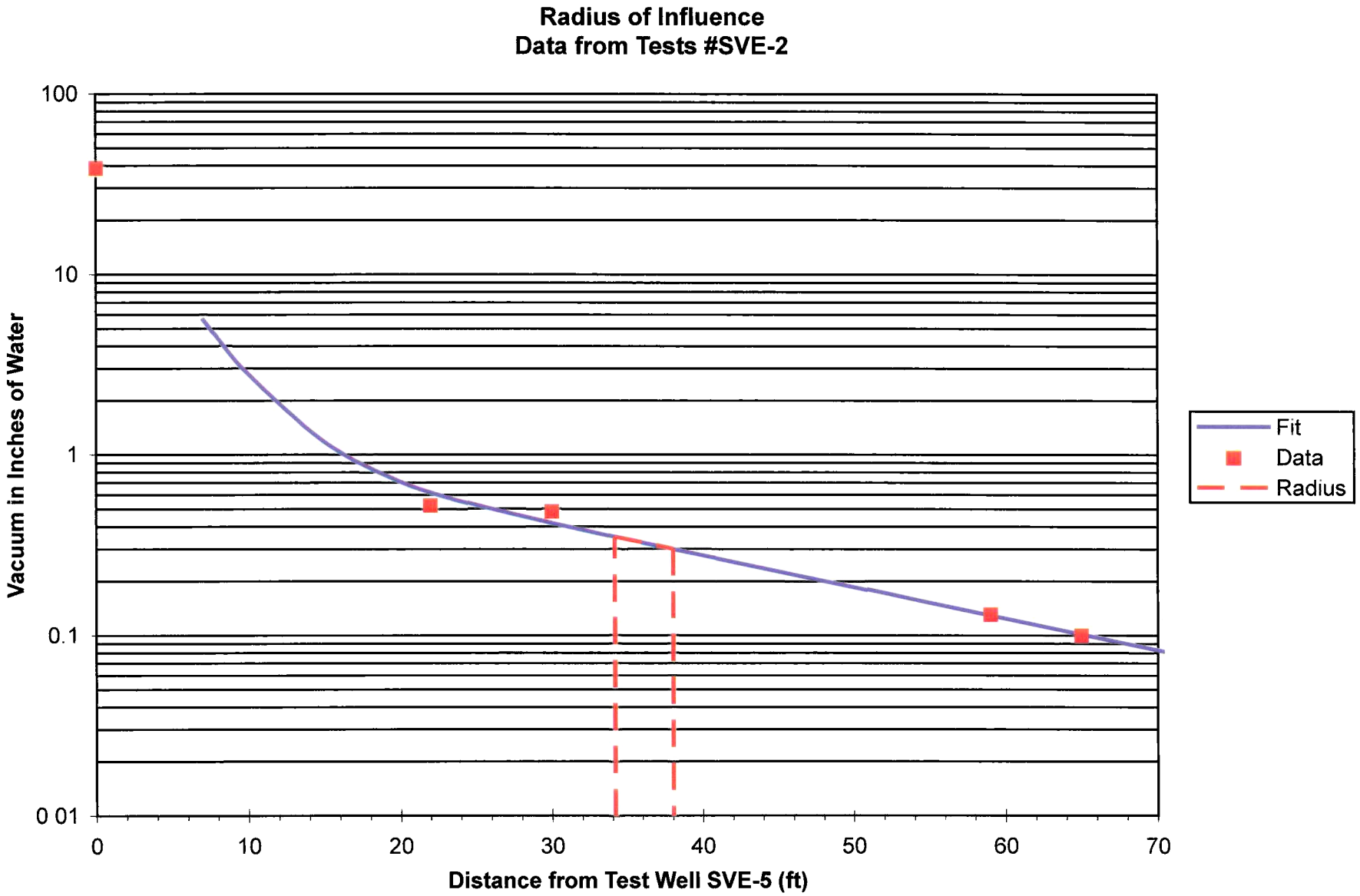











Radius of Influence
Data from Tests #SVE-2
Vacuum in Inches of Water
100
10
1
0.1
0 01
0
10
20
30
40
50
60
70
Distance from Test Well SVE-5 (ft)
Fit
Data
Radius

OPERATING DATA - TEST # SVE-2 PAGE # 1 ACUVAC SVE SYSTEM

Location: MONTEZUMA REMEDIATION, SANTA FE, NM Project Engineer: SADLER, LUNDGREN, MATHEWS

		Date:	11.08.09	-	-	-	-	-
	Parameters		Time 0725	Time 0730	Time 0900	Time 0830	Time 0900	Time 0930
	SVE-5		Hr Meter 5013.4	Hr Meter 5013.5	Hr Meter 5014.0	Hr Meter 5014.5	Hr Meter 5015.0	Hr Meter 5015.5
ENGINE/BLOWER	R.P.M.		1600	2100	2100	2100	2100	2100
	Oil Pressure	psi	50	50	50	50	50	50
	Water Temp	°F	132	160	160	160	160	160
	Volts		13	13	13	13	13	13
	Intake Vac.	"Hg	18	18	18	18	18	18
	Gas Flow Fuel/Propane	cfh	90	140	140	140	140	140
ATMOSPHERE/VAPOR/AIR	Dilution Air Flow	scfm	12	13	13	7	7	6
	Extraction Well Flow SVE-5	scfm	-	17.73	17.73	24.38	24.38	25.35
	Extraction Well Vac SVE-5	"H_2O	-	15.0	15.0	20.0	20.0	20.0
	Influent Vapor Temp.	°F	-	63.0	63.0	63.0	63.0	63.0
	Air Temp	°F	42.1	42.1	44.9	47.3	49.1	49.5
	Barometric Pressure	"Hg	30.19	30.19	30.20	30.21	30.21	30.24
	Absolute Pressure ELV 6958.	"Hg	22.65	22.65	22.66	22.67	22.67	22.70
1	22.0 MW-6	"H_2O	.03	.19	.18	.28	.31	.32
2	30.0 MW-5	"H_2O	.01	.15	.19	.31	.29	.32
4	57.0 CMW-5	"H_2O	(.22)	(2.90)	(3.85)	(3.21)	(2.90)	(2.47)
6	59.0 SVE-1	"H_2O	.01	.03	.05	.09	.06	.07
7	65.0 CMW-4	"H_2O	.01	.03	.03	.06	.06	.03
3	81.0 MW-7	"H_2O	.01	.01	.01	.07	.03	.06
8	101.0 SVE-4	"H_2O	.01	.02	.02	.03	.03	.03
5	104.0 SVE-2	"H_2O	.01	.02	.02	.03	.02	.03
9	115.0 CMW-6	"H_2O	.01	.03	.02	.03	.03	.03
MONITOR WELL VACUUM		"H_2O						
		"H_2O						
		"H_2O						
MANIFOLD	SVE	ON/OFF	OFF	ON	ON	ON	ON	ON
	Data Logger	ft	-	5.094	5.176	5.424	5.468	5.498
	GW Upwelling	ft	-	0.369	0.451	0.699	0.743	0.773
	Extraction Well	DTLNAPL	30.38					
	Extraction Well	DTGW	30.40					

() Indicates Well Pressure

LNAPL = 0.02'

TEST	Instrument	HORIBA	HORIBA				
	Well #	SVE-5	SVE-5				
	Time	0745	0545				
VAPOR/INFLUENT	HC ppmv	13,240	8940				
	CO_2 %	7.46	7.14				
	CO %	0.03	0				
	O_2 %	9.5	10.3				
	LEL %	55	45				

OPERATING DATA AND NOTES

DATE: 11/08/09 MONTEZUMA REMEDIATION, SANTA FE, NM TEST NO: SVE-2 Page No: 1

0630	Arrived at location, positioned SVE System near well # SVE-5 as the
	extraction well (EW). Opened selected wells & gauged DTGW/LNAPL.
	Mobilized SVE equipment, plugged outer wells, installed Data Logger in EW.
	Safety checks, all OK. GW temp 56.335°F
0725	Recorded static data; Recording slight well vacuums from .01 - .03.
	Well CMW-5 recording well pressure.
0730	Start Test # SVE-2 Initial EW induced vacuum set @ 15" H_2O, with
	vapor well flow of 17.73 SCFM. GW/LNAPL upwelling 0.5 Ft.
0745	HORIBA Data: HC = 13,240 ppmv, CO_2 = 7.46%, CO = 0.03%, O_2 = 9.5%, LEL = 55%
0800	Recorded Data: BP ↑ Outer wells, minimal increases
0815	Increased EW vacuum to 30.0" H_2O, WF @ 24.38 SCFM.
0830	Recorded Data: All outer wells recording increased levels of vacuum.
0845	HORIBA Data: BP ↑ HC = 8,940 ppmv ↓, CO_2 = 7.14% ↓, CO = 0, O_2 = 10.3% ↑, LEL = 45 ↓
0900	Recorded Data: BP — Outer wells variable — increases/decreases.
0930	Recorded Data: BP ↑↑↑ Outer wells variable. Slight increases/decreases
	Note: Increased well vapor flow of 25.35 SCFM.

Form/19950

OPERATING DATA - TEST # SVE-2 PAGE # 2 ACUVAC SVE SYSTEM

Location: MONTEZUMA REMEDIATION, SANTA FE, NM Project Engineer: SADLER, LUNDEEN, MATHEWS

	Date:	11.08.09	-	-	-	-	-
	Parameters	Time / Hr Meter	Time / Hr Meter	Time / Hr Meter	Time / Hr Meter	Time / Hr Meter	Time / Hr Meter
	SVE-5	1000 / 5016.0	1030 / 5016.5	1100 / 5017.0	1130 / 5017.5	1200 / 5018.0	1230 / 5018.5
ENGINEBLOWER	R.P.M.	2100	2100	2100	2100	2100	2200
	Oil Pressure psi	50	50	50	50	50	50
	Water Temp °F	160	160	160	160	160	160
	Volts	13	13	13	13	13	13
	Intake Vac. "Hg	18	18	18	18	18	18
	Gas Flow Fuel/Propane cfh	140	150	150	150	150	150
ATMOSPHERE/VAPOR/AIR	Dilution Air Flow scfm	6	0	0	0	0	0
	Extraction Well Flow SVE-5 scfm	25.35	31.01	31.01	32.07	33.21	34.41
	Extraction Well Vac. "H_2O	25.0	25.0	25.0	25.0	25.0	25.0
	Influent Vapor Temp. °F	63.0	63.0	63.0	63.0	63.0	63.0
	Air Temp °F	50.9	51.3	53.5	61.1	63.2	65.8
	Barometric Pressure "Hg	30.25	30.25	30.24	30.22	30.22	30.21
	Absolute Pressure "Hg	22.71	22.71	22.70	22.68	22.68	22.67
1	MW-6 "H_2O	.29	.35	.36	.36	.35	.41
2	MW-5 "H_2O	.31	.35	.35	.35	.33	.40
4	CMW-5 "H_2O	(2.29)	(2.17)	(2.13)	(2.10)	(2.07)	(1.95)
6	SVE-1 "H_2O	.06	.06	.09	.09	.07	.09
7	CMW-4 "H_2O	.03	.06	.05	.03	.05	.05
3	MW-7 "H_2O	.03	.03	.02	.02	.01	.05
8	SVE-4 "H_2O	.05	.05	.02	.02	.03	.01
5	SVE-2 "H_2O	.03	.02	.02	.01	.03	.02
1	CMW-6 "H_2O	.02	.02	.05	.02	.03	.03
MONITOR WELL VACUUM	"H_2O						
	"H_2O						
	"H_2O						
MANIFOLD	SVE ON/OFF	ON	ON	ON	ON	ON	ON
	Data Logger ft	5.564	5.677	5.755	5.780	5.792	5.875
	GW Upwelling ft	0.934	0.952	1.030	1.055	1.067	1.150
	Extraction Well DTLNAPL						
	Extraction Well DTGW						

() Indicates Well Pressure

TEST	Instrument	HORIBA	HORIBA	HORIBA			
	Well #	SVE-5	SVE-5	SVE-5			
	Time	0945	1045	1145			
VAPOR/INFLUENT	HC ppmv	6,480	5,170	4,130			
	CO_2 %	5.98	6.20	5.04			
	CO %	0	0.01	0			
	O_2 %	12.3	13.4	14.4			
	LEL %	33	30	25			

OPERATING DATA AND NOTES

DATE: 11/05/09 MONTEZUMA REMEDIATION, SANTA FE, NM TEST NO: SVE-2 Page No: 2

0945	HORIBA Data: BP↑ HC = 6,480ppmv↓, CO_2 = 5.98%↓, CO = 0 —, O_2 = 12.3%↑, LEL = 33↓
1000	Recorded Data: All outer wells on decreasing trend. Increase final vacuum to 25" H_2O, well flow @ 31.01 scfm.
1030	Recorded Data: BP — Outer wells MW-6 & 5 & CMW-4, slight increasing vacuum trend. All other wells steady.
1045	HORIBA Data: BP — HC = 5,170ppmv↓, CO_2 = 6.20%↑, CO = 0.01%↑, O_2 = 13.4%↑, LEL = 30↓
1100	Recorded Data: BP↓ Outer wells variable, slight increases/decreases
1130	Recorded Data: BP↓↓ Outer wells variable, w/ slight decreases.
1145	HORIBA Data: HC = 4,130ppmv↓, CO_2 = 5.04%↓, CO = 0↓, O_2 = 14.4%↑, LEL = 25↓
1200	Recorded Data: BP — Outer wells steady.
1230	Recorded Data: BP↓ Outer wells mostly on an increasing trend. Increased well vapor flow of 34.41 scfm.

Form/19950

OPERATING DATA - TEST # SVE-2 PAGE # 3 ACUVAC SVE SYSTEM

Location: MONTEZUMA REMEDIATION, SANTA FE, NM Project Engineer: SADLER, LUNDGREN, MATHEWS

		Date:	11.08.01	—	—	—	—	—
		Parameters	Time	Time	Time	Time	Time	Time
			1300	1330	1400	1430	1500	1530
			Hr Meter	Hr Meter	Hr Meter	Hr Meter	Hr Meter	Hr Meter
		SVE-5	5019.0	5019.5	5020.0	5020.5	5021.0	5021.5
ENGINEBLOWER		R.P.M.	2200	2300	2400	2500	2600	1000
		Oil Pressure psi	50	50	50	50	50	50
		Water Temp °F	160	160	160	160	160	160
		Volts	13	13	13	13	13	13
		Intake Vac. "Hg	18	18	18	18	18	18
		Gas Flow Fuel/Propane cfh	150	150	150	150	150	90
ATMOSPHERE/VAPOR/AIR		Dilution Air Flow scfm	0	0	0	0	0	12
		Extraction Well Flow scfm SVE-5	36.37	46.85	51.04	58.32	6038	OFF
		Extraction Well Vac. "H_2O SVE-5	25.0	30.0	30.0	35.0	35.0	OFF
		Influent Vapor Temp. °F	63.0	63.0	63.0	63.0	63.0	N/A
		Air Temp °F	66.9	64.3	63.6	61.1	59.2	58.8
		Barometric Pressure "Hg	30.20	30.19	30.19	30.18	30.18	30.19
		Absolute Pressure "Hg	22.66	22.65	22.65	22.64	22.64	22.65
1	MONITOR WELL VACUUM	MW-6 "H_2O	.39	.44	.49	.58	.57	(.01)
2		MW-5 "H_2O	.38	.44	.42	.52	.50	(.01)
4		CMW-5 "H_2O	(1.87)	(1.86)	(1.74)	(1.61)	(1.46)	(.46)
6		SVE-1 "H_2O	.11	.11	.10	.13	.14	(.01)
7		CMW-4 "H_2O	.01	.03	.06	.09	.10	(.01)
3		MW-7 "H_2O	.03	.05	.06	.05	.05	(.01)
8		SVE-4 "H_2O	.02	.01	.03	.03	.06	(.01)
5		SVE-2 "H_2O	.03	.03	.02	.02	.03	(.01)
9		CMW-6 "H_2O	.02	.01	.03	.05	.03	(.01)
		"H_2O						
		"H_2O						
		"H_2O						
	MANIFOLD	SVE ON/OFF	ON	ON	ON	ON	ON	OFF
		Data Logger ft	5.917	6.059	6.086	6.275	6.309	—
		GW Upwelling ft	1.192	1.334	1.361	1.550	1.665	—
		Extraction Well DTLNAPL						28.56
		Extraction Well DTGW						28.66

STATIC

() Indicates Well Pressure

LNAPL = 0.10

TEST	Instrument	HORIBA	HORIBA	HORIBA			
	Well #	SVE-5	SVE-5	SVE-5			
	Time	1245	1345	1445			
VAPOR/INFLUENT	HC ppmv	4,240	3,760	3,060			
	CO_2 %	5.24	5.14	5.72			
	CO %	0	0	0			
	O_2 %	14.7	16.8	15.2			
	LEL %	26	21	18			

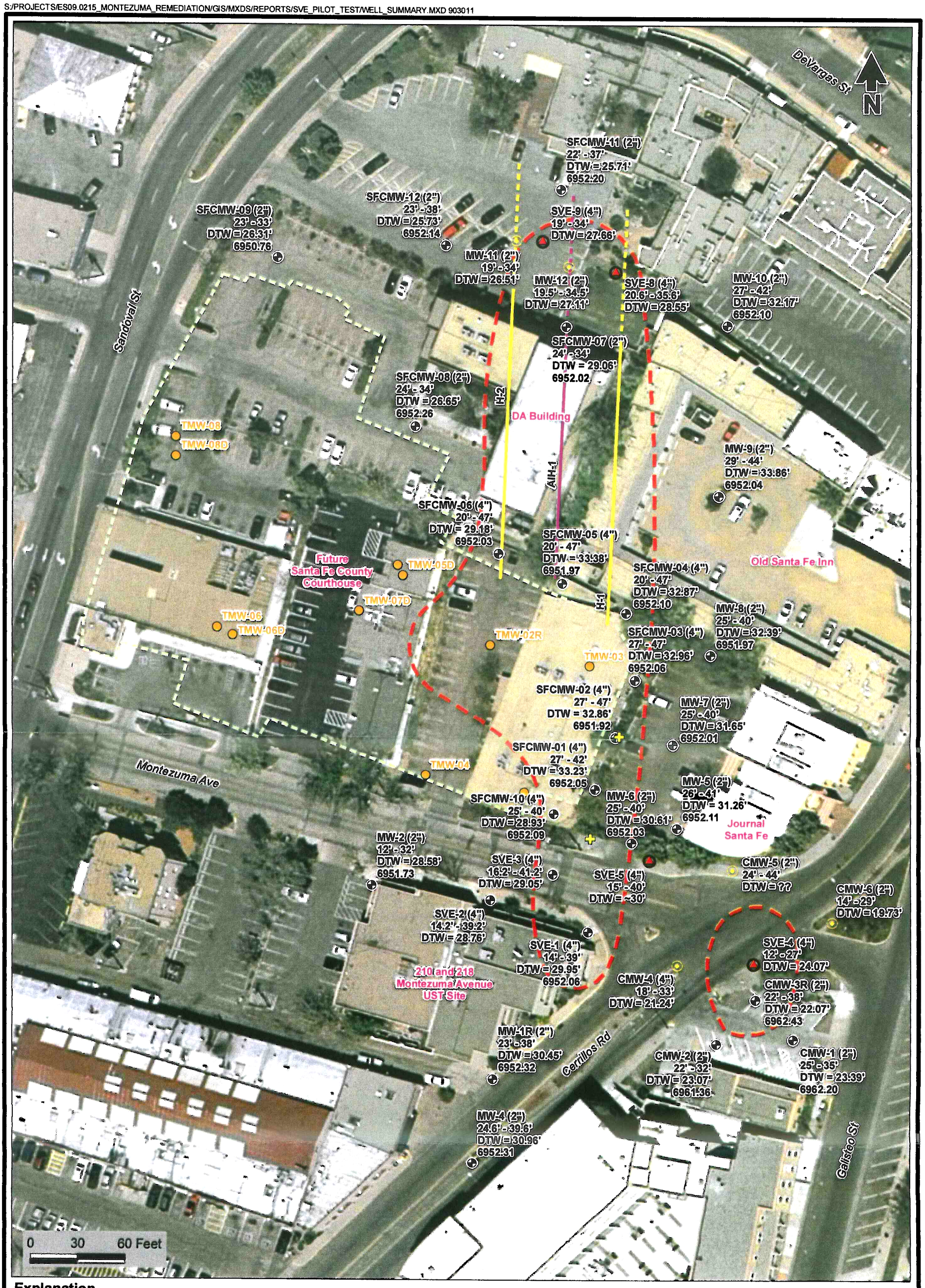
OPERATING DATA AND NOTES

DATE: 11/05/09 MONTEZUMA REMEDIATION, SANTAFE, NM TEST NO: SVE-2 Page No: 3

1245	HORIBA Data: HC = 4,240 ppmv ↑, CO_2 = 5.24% ↑, CO = 0 —, O_2 = 14.7%, LEL = 26 ↑
1300	Recorded Data: BP ↓ Over wells variable, slight increases/decreases
	Increased EW vacuum to 30" H_2O, Vapor well flow @ 46.85 scfm.
1330	Recorded Data: BP ↓ Over wells MW-5 & 6 recorded an increased vacuum trend. Other wells variable, slight increases/decreases.
1345	HORIBA Data: HC = 3,760 ppmv ↓, CO_2 = 5.14% ↓, CO = 0 —, O_2 = 16.8% ↑, LEL = 21 ↓
1400	Recorded Data: BP — Over wells variable, slight increases/decreases.
	Increased EW vacuum to 35" H_2O, WF @ 58.32 scfm.
1430	Recorded Data: BP ↓ Over wells MW-6 & 5, SVE-1, CMW-4 & 6 on increasing vacuum trend, other wells steady. Increased well vapor flow of 58.32 scfm.
1445	HORIBA Data: HC = 3,060 ppmv ↓, CO_2 = 5.72% ↑, CO = 0 —, O_2 = 15.2 ↓, LEL = 18 ↓
1500	Recorded Data: BP — Over wells variable, slight increases/decreases.
	Note: WF continues on increasing trend @ 60.38 scfm.
	Discontinued SVE test to allow wells to adjust to atmospheric conditions.
1530	All wells recording slight well pressures.
1630	Secured all wells. Departed site.

Form/19950

S:/PROJECTS/ES09.0215_MONTEZUMA_REMEDIATION/GIS/MXDS/REPORTS/SVE_PILOT_TEST/WELL_SUMMARY.MXD 903011



Explanation

- Well location
- Temporary monitor well location
- Recently installed SVE well
- Recently installed monitor well
- Proposed air injection well
- Proposed horizontal SVE well
- Proposed horizontal injection well
- Approximate extent of existing excavation
- Approximate extent of NAPL
- Estimated SVE area of influence

MW-4 (2") Well designation (size)
24.6' 39.6' Screen interval
DTW = 30.96' Depth to water (feet)
6952.31 Corrected groundwater elevation (ft msl)

Sources: 1. RGIS aerial photograph dated April 26, 2005 acquired via Google Earth
2. Intera, 2009

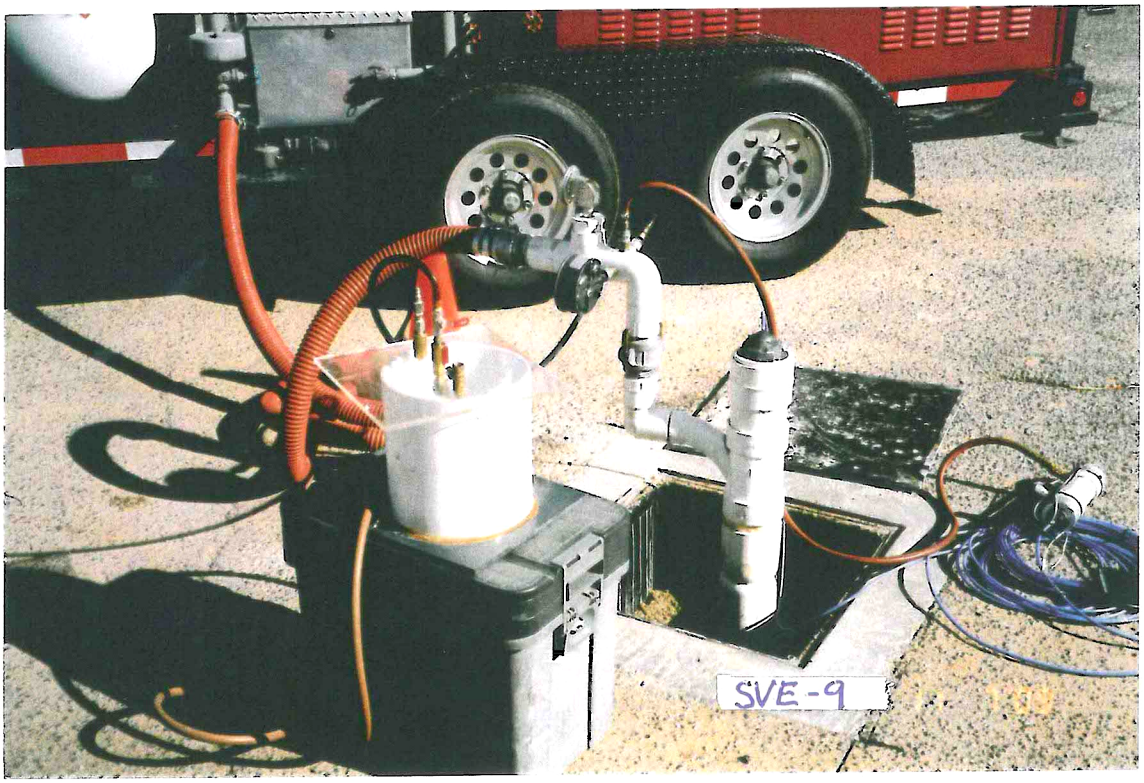
Figure 1

MONTEZUMA REMEDIATION

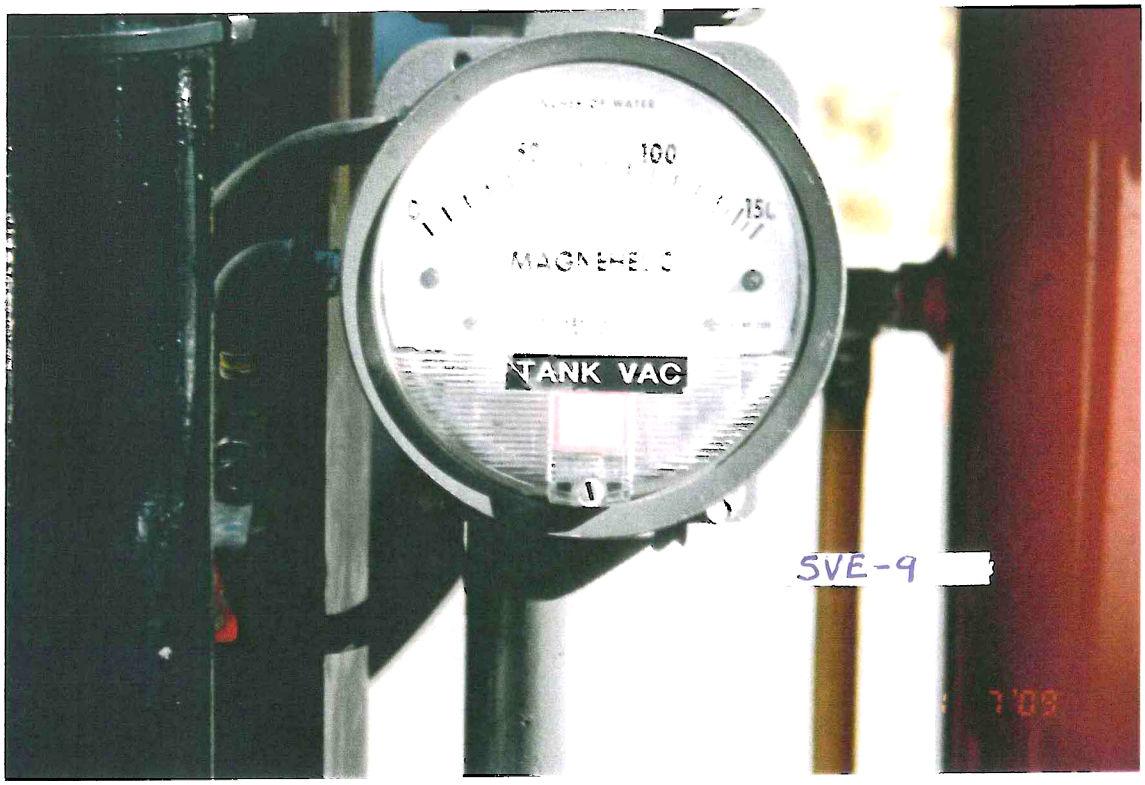
Site Well Summary

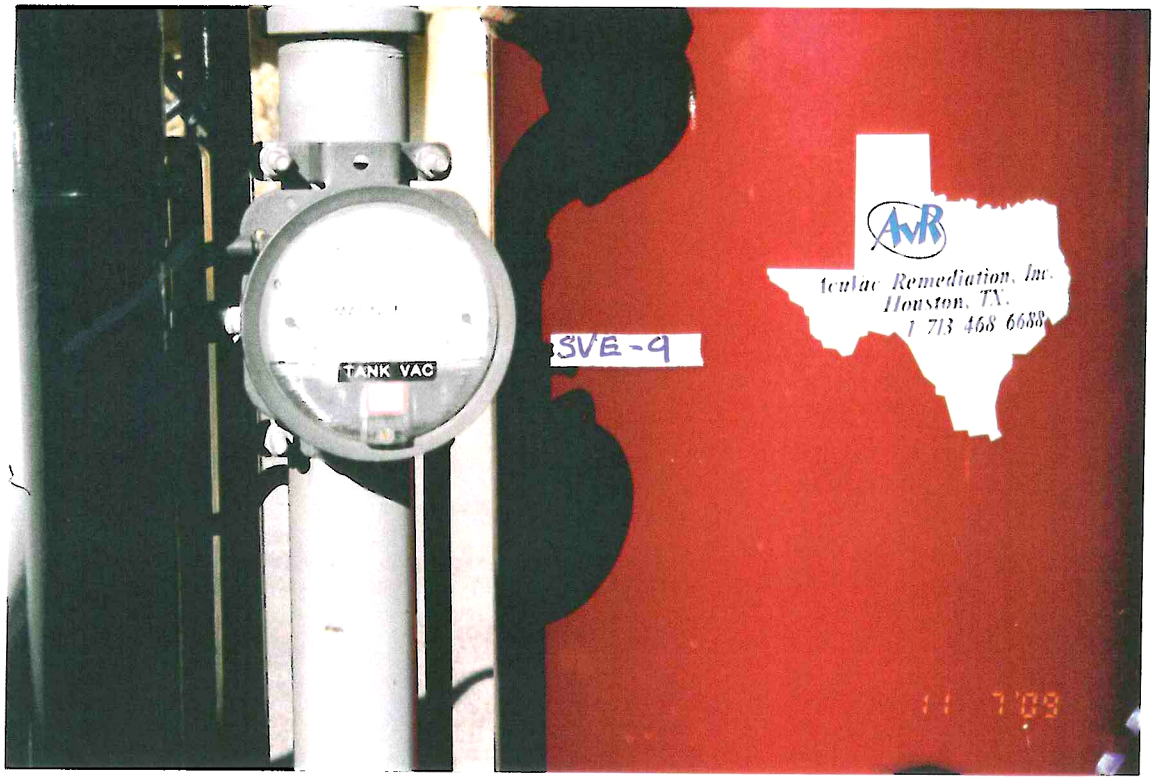
Daniel B. Stephens & Associates, Inc.
11/03/2009 JN ES09.0215

MONTEZUMA REMEDIATION
SANTA FE, NM



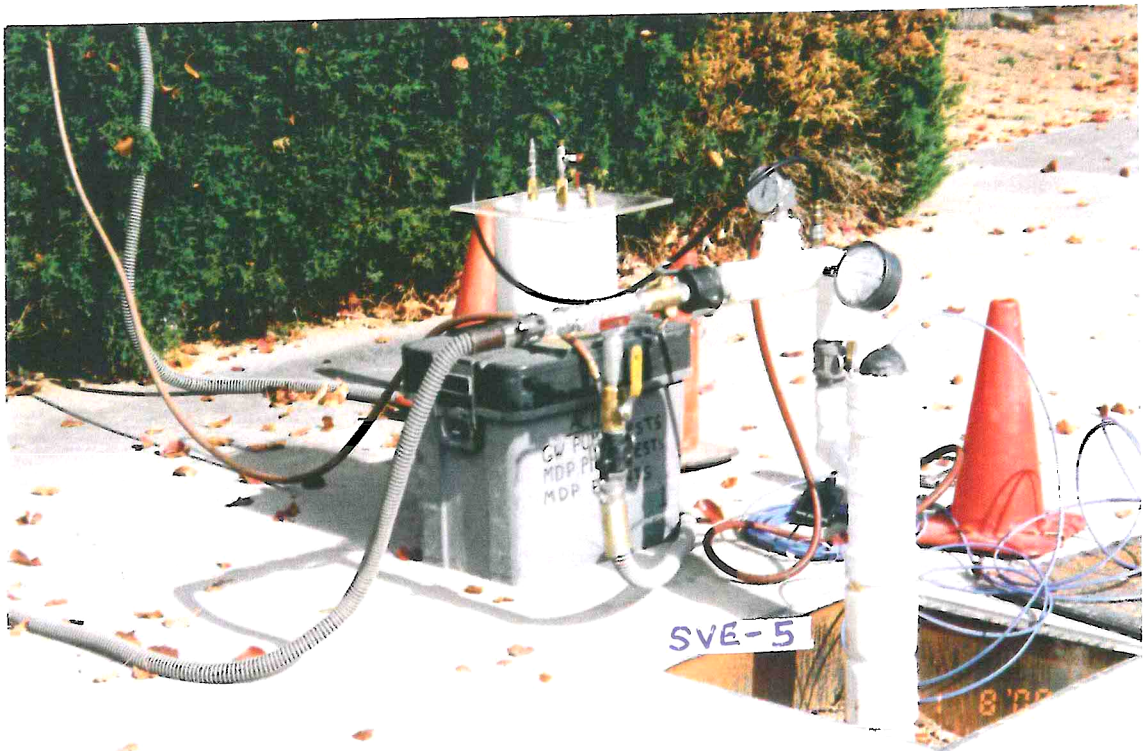
MONTEZUMA REMEDIATION
SANTA FE, NM





MONTEZUMA REMEDIATION
SANTA FE, NM

MONTEZUMA REMEDIATION
SANTA FE, NM



MONTEZUMA REMEDIATION
SANTA FE, NM

HALL
ENVIRONMENTAL
ANALYSIS
LABORATORY

COVER LETTER

Tuesday, November 17, 2009

Gundar Peterson
Daniel B. Stephens & Assoc.
6020 Academy NE Suite 100
Albuquerque, NM 87109

TEL: (505) 822-9400
FAX (505) 822-8877

RE: Montezuma Remediation

Order No.: 0911181

Dear Gundar Peterson:

Hall Environmental Analysis Laboratory, Inc. received 6 sample(s) on 11/9/2009 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. Below is a list of our accreditations. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites.

Reporting limits are determined by EPA methodology. No determination of compounds below these (denoted by the ND or < sign) has been made.

Please don't hesitate to contact HEAL for any additional information or clarifications.

Sincerely,

for Andy Freeman, Laboratory Manager

NM Lab # NM9425 NM0901
AZ license # AZ0682
ORELAP Lab # NM100001
Texas Lab# T104704424-08-TX

Hall Environmental Analysis Laboratory, Inc.

Date: *17-Nov-09*

CLIENT:	Daniel B. Stephens & Assoc.	**Client Sample ID:**	SVE-9 Pilot Inf @ 0915
Lab Order:	0911181	**Collection Date:**	11/7/2009 9:15:00 AM
Project:	Montezuma Remediation	**Date Received:**	11/9/2009
Lab ID:	0911181-01	**Matrix:**	AIR

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015B: GASOLINE RANGE						Analyst: **NSB**
Gasoline Range Organics (GRO)	340000	5000		µg/L	1000	11/16/2009 1:43:54 PM
Surr: BFB	107	76.8-150		%REC	1000	11/16/2009 1:43:54 PM
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**
Methyl tert-butyl ether (MTBE)	ND	63		µg/L	250	11/13/2009 2:39:54 PM
Benzene	3100	100		µg/L	1000	11/16/2009 1:43:54 PM
Toluene	4800	100		µg/L	1000	11/16/2009 1:43:54 PM
Ethylbenzene	450	25		µg/L	250	11/13/2009 2:39:54 PM
Xylenes, Total	1600	75		µg/L	250	11/13/2009 2:39:54 PM
Surr: 4-Bromofluorobenzene	105	70.2-105		%REC	250	11/13/2009 2:39:54 PM

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
E	Estimated value	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	MCL	Maximum Contaminant Level
ND	Not Detected at the Reporting Limit	RL	Reporting Limit
S	Spike recovery outside accepted recovery limits		

Hall Environmental Analysis Laboratory, Inc.

Date: *17-Nov-09*

CLIENT:	Daniel B. Stephens & Assoc.	**Client Sample ID:**	SVE-9 Pilot Inf @ 1215
Lab Order:	0911181	**Collection Date:**	11/7/2009 12:15:00 PM
Project:	Montezuma Remediation	**Date Received:**	11/9/2009
Lab ID:	0911181-02	**Matrix:**	AIR

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015B: GASOLINE RANGE						Analyst: **NSB**
Gasoline Range Organics (GRO)	240000	2500		µg/L	500	11/13/2009 3:09:13 PM
Surr: BFB	108	76.8-150		%REC	500	11/13/2009 3:09:13 PM
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**
Methyl tert-butyl ether (MTBE)	ND	130		µg/L	500	11/13/2009 3:09:13 PM
Benzene	1700	50		µg/L	500	11/13/2009 3:09:13 PM
Toluene	3100	50		µg/L	500	11/13/2009 3:09:13 PM
Ethylbenzene	380	50		µg/L	500	11/13/2009 3:09:13 PM
Xylenes, Total	1600	150		µg/L	500	11/13/2009 3:09:13 PM
Surr: 4-Bromofluorobenzene	101	70.2-105		%REC	500	11/13/2009 3:09:13 PM

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
E	Estimated value	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	MCL	Maximum Contaminant Level
ND	Not Detected at the Reporting Limit	RL	Reporting Limit
S	Spike recovery outside accepted recovery limits		

Hall Environmental Analysis Laboratory, Inc.

Date: *17-Nov-09*

CLIENT:	Daniel B. Stephens & Assoc.	**Client Sample ID:**	SVE-9 Pilot Inf @ 1430
Lab Order:	0911181	**Collection Date:**	11/7/2009 2:30:00 PM
Project:	Montezuma Remediation	**Date Received:**	11/9/2009
Lab ID:	0911181-03	**Matrix:**	AIR

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015B: GASOLINE RANGE						Analyst: **NSB**
Gasoline Range Organics (GRO)	330000	2500		µg/L	500	11/13/2009 3:38:30 PM
Surr: BFB	106	76.8-150		%REC	500	11/13/2009 3:38:30 PM
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**
Methyl tert-butyl ether (MTBE)	ND	130		µg/L	500	11/13/2009 3:38:30 PM
Benzene	2300	50		µg/L	500	11/13/2009 3:38:30 PM
Toluene	4400	50		µg/L	500	11/13/2009 3:38:30 PM
Ethylbenzene	470	50		µg/L	500	11/13/2009 3:38:30 PM
Xylenes, Total	1700	150		µg/L	500	11/13/2009 3:38:30 PM
Surr: 4-Bromofluorobenzene	102	70.2-105		%REC	500	11/13/2009 3:38:30 PM

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
E	Estimated value	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	MCL	Maximum Contaminant Level
ND	Not Detected at the Reporting Limit	RL	Reporting Limit
S	Spike recovery outside accepted recovery limits		

Hall Environmental Analysis Laboratory, Inc.

Date: *17-Nov-09*

CLIENT:	Daniel B. Stephens & Assoc.	**Client Sample ID:**	SVE-5 Pilot Inf @ 0845
Lab Order:	0911181	**Collection Date:**	11/8/2009 8:45:00 AM
Project:	Montezuma Remediation	**Date Received:**	11/9/2009
Lab ID:	0911181-04	**Matrix:**	AIR

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015B: GASOLINE RANGE						Analyst: **NSB**
Gasoline Range Organics (GRO)	36000	2500		µg/L	500	11/13/2009 4:07:48 PM
Surr: BFB	97.6	76.8-150		%REC	500	11/13/2009 4:07:48 PM
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**
Methyl tert-butyl ether (MTBE)	ND	130		µg/L	500	11/13/2009 4:07:48 PM
Benzene	160	50		µg/L	500	11/13/2009 4:07:48 PM
Toluene	400	50		µg/L	500	11/13/2009 4:07:48 PM
Ethylbenzene	120	50		µg/L	500	11/13/2009 4:07:48 PM
Xylenes, Total	470	150		µg/L	500	11/13/2009 4:07:48 PM
Surr: 4-Bromofluorobenzene	89.5	70.2-105		%REC	500	11/13/2009 4:07:48 PM

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
E	Estimated value	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	MCL	Maximum Contaminant Level
ND	Not Detected at the Reporting Limit	RL	Reporting Limit
S	Spike recovery outside accepted recovery limits		

Hall Environmental Analysis Laboratory, Inc.

Date: *17-Nov-09*

CLIENT:	Daniel B. Stephens & Assoc.	**Client Sample ID:**	SVE-5 Pilot Inf @ 1145
Lab Order:	0911181	**Collection Date:**	11/8/2009 11:45:00 AM
Project:	Montezuma Remediation	**Date Received:**	11/9/2009
Lab ID:	0911181-05	**Matrix:**	AIR

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015B: GASOLINE RANGE						Analyst: **NSB**
Gasoline Range Organics (GRO)	19000	2500		µg/L	500	11/13/2009 4:37:13 PM
Surr: BFB	102	76.8-150		%REC	500	11/13/2009 4:37:13 PM
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**
Methyl tert-butyl ether (MTBE)	ND	130		µg/L	500	11/13/2009 4:37:13 PM
Benzene	72	50		µg/L	500	11/13/2009 4:37:13 PM
Toluene	230	50		µg/L	500	11/13/2009 4:37:13 PM
Ethylbenzene	67	50		µg/L	500	11/13/2009 4:37:13 PM
Xylenes, Total	270	150		µg/L	500	11/13/2009 4:37:13 PM
Surr: 4-Bromofluorobenzene	96.0	70.2-105		%REC	500	11/13/2009 4:37:13 PM

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
E	Estimated value	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	MCL	Maximum Contaminant Level
ND	Not Detected at the Reporting Limit	RL	Reporting Limit
S	Spike recovery outside accepted recovery limits		

Hall Environmental Analysis Laboratory, Inc.

Date: *17-Nov-09*

CLIENT:	Daniel B. Stephens & Assoc.	**Client Sample ID:**	SVE-5 Pilot Inf @ 14.00
Lab Order:	0911181	**Collection Date:**	11/8/2009 2:00:00 PM
Project:	Montezuma Remediation	**Date Received:**	11/9/2009
Lab ID:	0911181-06	**Matrix:**	AIR

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015B: GASOLINE RANGE						Analyst: **NSB**
Gasoline Range Organics (GRO)	16000	2500		µg/L	500	11/13/2009 5:06:26 PM
Surr: BFB	87.3	76.8-150		%REC	500	11/13/2009 5:06:26 PM
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**
Methyl tert-butyl ether (MTBE)	ND	130		µg/L	500	11/13/2009 5:06:26 PM
Benzene	59	50		µg/L	500	11/13/2009 5:06:26 PM
Toluene	190	50		µg/L	500	11/13/2009 5:06:26 PM
Ethylbenzene	56	50		µg/L	500	11/13/2009 5:06:26 PM
Xylenes, Total	230	150		µg/L	500	11/13/2009 5:06:26 PM
Surr: 4-Bromofluorobenzene	78.6	70.2-105		%REC	500	11/13/2009 5:06:26 PM

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
E	Estimated value	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	MCL	Maximum Contaminant Level
ND	Not Detected at the Reporting Limit	RL	Reporting Limit
S	Spike recovery outside accepted recovery limits		

QA/QC SUMMARY REPORT

Client: Daniel B. Stephens & Assoc.
Project: Montezuma Remediation **Work Order:** 0911181

Analyte	Result	Units	PQL	SPK Va	SPK ref	%Rec	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Method: EPA Method 8015B: Gasoline Range											
Sample ID: 5ML RB		*MBLK*				Batch ID:	**R36179**	Analysis Date:	11/13/2009 10:41:17 AM		
Gasoline Range Organics (GRO)	ND	mg/L	0.050								
Sample ID: 2.5UG GRO LCS		*LCS*				Batch ID:	**R36179**	Analysis Date:	11/13/2009 7:38:06 PM		
Gasoline Range Organics (GRO)	0.4840	mg/L	0.050	0.5	0	96.8	80	115			
Method: EPA Method 8021B: Volatiles											
Sample ID: 5ML RB		*MBLK*				Batch ID:	**R36179**	Analysis Date:	11/13/2009 10:41:17 AM		
Methyl tert-butyl ether (MTBE)	ND	µg/L	2.5								
Benzene	ND	µg/L	1.0								
Toluene	ND	µg/L	1.0								
Ethylbenzene	ND	µg/L	1.0								
Xylenes, Total	ND	µg/L	2.0								
1,2,4-Trimethylbenzene	ND	µg/L	1.0								
1,3,5-Trimethylbenzene	ND	µg/L	1.0								
Sample ID: 100NG BTEX LCS		*LCS*				Batch ID:	**R36179**	Analysis Date:	11/13/2009 8:38:43 PM		
Methyl tert-butyl ether (MTBE)	17.21	µg/L	2.5	20	0	86.1	51.2	138			
Benzene	18.56	µg/L	1.0	20	0	92.8	85.9	113			
Toluene	18.79	µg/L	1.0	20	0	94.0	86.4	113			
Ethylbenzene	17.97	µg/L	1.0	20	0	89.8	83.5	118			
Xylenes, Total	53.88	µg/L	2.0	60	0	89.8	83.4	122			
1,2,4-Trimethylbenzene	18.33	µg/L	1.0	20	0.158	90.8	83.5	115			
1,3,5-Trimethylbenzene	17.11	µg/L	1.0	20	0	85.5	85.2	113			

Qualifiers:

E	Estimated value	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	S	Spike recovery outside accepted recovery limits

QA/QC SUMMARY REPORT

Client: Daniel B. Stephens & Assoc.
Project: Montezuma Remediation **Work Order:** 0911181

Analyte	Result	Units	PQL	SPK Va	SPK ref	%Rec	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Method: EPA Method 8015B: Gasoline Range											
Sample ID: MB-2061		*MBLK*				Batch ID:	**R36195**	Analysis Date:	11/17/2009 6:21:17 AM		
Gasoline Range Organics (GRO)	ND	mg/Kg	5.0								
Sample ID: LCS-2061		*LCS*				Batch ID:	**R36195**	Analysis Date:	11/17/2009 5:50:49 AM		
Gasoline Range Organics (GRO)	26.26	mg/Kg	5.0	25	1.79	97.9	64.4	133			
Method: EPA Method 8015B: Gasoline Range											
Sample ID: 2.5UG GRO LCS		*LCS*				Batch ID:	**R36195**	Analysis Date:	11/16/2009 10:16:01 PM		
Gasoline Range Organics (GRO)	0.4734	mg/L	0.050	0.5	0	94.7	80	115			
Method: EPA Method 8021B: Volatiles											
Sample ID: 5ML RB		*MBLK*				Batch ID:	**R36195**	Analysis Date:	11/16/2009 10:38:23 AM		
Methyl tert-butyl ether (MTBE)	ND	µg/L	2.5								
Benzene	ND	µg/L	1.0								
Toluene	ND	µg/L	1.0								
Ethylbenzene	ND	µg/L	1.0								
Xylenes, Total	ND	µg/L	2.0								
1,2,4-Trimethylbenzene	ND	µg/L	1.0								
1,3,5-Trimethylbenzene	ND	µg/L	1.0								
Sample ID: 100NG BTEX LCS		*LCS*				Batch ID:	**R36195**	Analysis Date:	11/16/2009 10:46:29 PM		
Methyl tert-butyl ether (MTBE)	17.53	µg/L	2.5	20	0	87.6	51.2	138			
Benzene	18.81	µg/L	1.0	20	0	94.0	85.9	113			
Toluene	20.13	µg/L	1.0	20	0	101	86.4	113			
Ethylbenzene	19.72	µg/L	1.0	20	0	98.6	83.5	118			
Xylenes, Total	57.69	µg/L	2.0	60	0	96.1	83.4	122			
1,2,4-Trimethylbenzene	18.78	µg/L	1.0	20	0.206	92.9	83.5	115			
1,3,5-Trimethylbenzene	17.79	µg/L	1.0	20	0	89.0	85.2	113			

Qualifiers:

E	Estimated value	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	S	Spike recovery outside accepted recovery limits

Hall Environmental Analysis Laboratory, Inc.

Sample Receipt Checklist

Client Name **DBS**

Date Received: **11/9/2009**

Work Order Number **0911181**

Received by: TLS

Sample ID labels checked by: _____ Initials

Checklist completed by: _____ Signature 11/9/09 Date

Matrix: Carrier name: Client drop-off

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐	
Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	Not Present ☐	Not Shipped ☑
Custody seals intact on sample bottles?	Yes ☐	No ☐	N/A ☑	
Chain of custody present?	Yes ☑	No ☐		
Chain of custody signed when relinquished and received?	Yes ☑	No ☐		
Chain of custody agrees with sample labels?	Yes ☑	No ☐		
Samples in proper container/bottle?	Yes ☑	No ☐		
Sample containers intact?	Yes ☑	No ☐		
Sufficient sample volume for indicated test?	Yes ☑	No ☐		
All samples received within holding time?	Yes ☑	No ☐		
Water - VOA vials have zero headspace?	No VOA vials submitted ☑	Yes ☐	No ☐	
Water - Preservation labels on bottle and cap match?	Yes ☐	No ☐	N/A ☑	
Water - pH acceptable upon receipt?	Yes ☐	No ☐	N/A ☑	
Container/Temp Blank temperature?		*<6° C Acceptable* If given sufficient time to cool.		

Number of preserved bottles checked for pH: _____

<2 >12 unless noted below.

COMMENTS:

Client contacted _____ Date contacted: _____ Person contacted _____

Contacted by: _____ Regarding: _____

Comments: _____

Corrective Action _____

Chain-of-Custody Record

Client: PBS&A

Mailing Address: 6020 Academy Rd NE
ABQ NM 87109

Phone #: 505-822-9400

email or Fax#: gpeterson@dbstephens.com

QA/QC Package:
☒ Standard ☐ Level 4 (Full Validation)

Accreditation
☐ NELAP ☐ Other _____

☐ EDD (Type) _____

Turn-Around Time:
☒ Standard ☐ Rush _____

Project Name: MONTEZUMA REMEDIATION

Project #: ES09.00215. SVE. 90002

Project Manager: G. PETERSON

Sampler: ACU VAC / T. GOLDEN

On Ice: ☐ Yes ☒ No

Sample Temperature:

HALL ENVIRONMENTAL ANALYSIS LABORATORY
www.hallenvironmental.com
4901 Hawkins NE - Albuquerque, NM 87109
Tel. 505-345-3975 Fax 505-345-4107

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 0911185
11/7/09	~~0900~~ 0915	Soil Vapor	SVE-9 PILOT INF @ ~~0900~~ 0915	2@ Tedlar bag	None	1
11/7/09	1215	Soil Vapor	SVE-9 PILOT INF @ 1215	2@ Tedlar bag	None	2
11/7/09	1430	Soil Vapor	SVE-9 PILOT INF @ 1430	2@ Tedlar bag	None	3
11/8/09	0845	Soil Vapor	SVE-5 PILOT INF @ 0845	2@ Tedlar bag	None	4
11/8/09	1145	Soil Vapor	SVE-5 PILOT INF @ 1145	2@ Tedlar bag	None	5
11/8/09	1400	Soil Vapor	SVE-5 PILOT INF @ 1400	2@ Tedlar bag	None	6

Analysis Request

BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH Method 8015B (Gas/Diesel)	TPH (Method 418.1)	EDB (Method 504.1)	8310 (PNA or PAH)	RCRA 8 Metals	Anions (F,Cl,NO_3,NO_2,PO_4,SO_4)	8081 Pesticides / 8082 PCB's	8260B (VOA)	8270 (Semi-VOA)					Air Bubbles (Y or N)
X		X													
X		X													
X		X													
X		X													
X		X													
X		X													

Date:	Time:	Relinquished by:	Received by:	Date	Time
11/9/09	0835			11/9/09	8:35
11/9	915			11/9/09	915

Remarks:

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

HALL
ENVIRONMENTAL
ANALYSIS
LABORATORY

COVER LETTER

Monday, December 28, 2009

Mike McVey
Daniel B. Stephens & Assoc.
6020 Academy NE Suite 100
Albuquerque, NM 87109

TEL: (505) 822-9400
FAX (505) 822-8877

RE: SFCJC

Order No.: 0912453

Dear Mike McVey:

Hall Environmental Analysis Laboratory, Inc. received 3 sample(s) on 12/21/2009 for the analyses presented in the following report.

These were analyzed according to EPA procedures or equivalent. Below is a list of our accreditations. To access our accredited tests please go to www.hallenvironmental.com or the state specific web sites.

Reporting limits are determined by EPA methodology. No determination of compounds below these (denoted by the ND or < sign) has been made.

Please don't hesitate to contact HEAL for any additional information or clarifications.

Sincerely,

Andy Freeman, Laboratory Manager

NM Lab # NM9425 NM0901
AZ license # AZ0682
ORELAP Lab # NM100001
Texas Lab# T104704424-08-TX

Hall Environmental Analysis Laboratory, Inc.

Date: *28-Dec-09*

CLIENT:	Daniel B. Stephens & Assoc.	**Client Sample ID:**	SVE-3 Pilot @ 0900
Lab Order:	0912453	**Collection Date:**	12/19/2009 9:00:00 AM
Project:	SFCJC	**Date Received:**	12/21/2009
Lab ID:	0912453-01	**Matrix:**	AIR

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015B: GASOLINE RANGE						Analyst: **NSB**
Gasoline Range Organics (GRO)	31000	500		µg/L	100	12/23/2009 12:24:03 PM
Surr: BFB	107	76.8-150		%REC	100	12/23/2009 12:24:03 PM
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**
Methyl tert-butyl ether (MTBE)	ND	25		µg/L	100	12/23/2009 12:24:03 PM
Benzene	110	10		µg/L	100	12/23/2009 12:24:03 PM
Toluene	280	10		µg/L	100	12/23/2009 12:24:03 PM
Ethylbenzene	52	10		µg/L	100	12/23/2009 12:24:03 PM
Xylenes, Total	180	30		µg/L	100	12/23/2009 12:24:03 PM
Surr: 4-Bromofluorobenzene	112	70.2-105	S	%REC	100	12/23/2009 12:24:03 PM

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
E	Estimated value	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	MCL	Maximum Contaminant Level
ND	Not Detected at the Reporting Limit	RL	Reporting Limit
S	Spike recovery outside accepted recovery limits		

Hall Environmental Analysis Laboratory, Inc.

Date: *28-Dec-09*

CLIENT:	Daniel B. Stephens & Assoc.	**Client Sample ID:**	SVE-3 Pilot @ 1130
Lab Order:	0912453	**Collection Date:**	12/19/2009 11:30:00 AM
Project:	SFCJC	**Date Received:**	12/21/2009
Lab ID:	0912453-02	**Matrix:**	AIR

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015B: GASOLINE RANGE						Analyst: **NSB**
Gasoline Range Organics (GRO)	39000	2500		µg/L	500	12/23/2009 1:56:13 PM
Surr: BFB	94.4	76.8-150		%REC	500	12/23/2009 1:56:13 PM
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**
Methyl tert-butyl ether (MTBE)	ND	130		µg/L	500	12/23/2009 1:56:13 PM
Benzene	150	50		µg/L	500	12/23/2009 1:56:13 PM
Toluene	390	50		µg/L	500	12/23/2009 1:56:13 PM
Ethylbenzene	63	50		µg/L	500	12/23/2009 1:56:13 PM
Xylenes, Total	180	150		µg/L	500	12/23/2009 1:56:13 PM
Surr: 4-Bromofluorobenzene	104	70.2-105		%REC	500	12/23/2009 1:56:13 PM

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
E	Estimated value	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	MCL	Maximum Contaminant Level
ND	Not Detected at the Reporting Limit	RL	Reporting Limit
S	Spike recovery outside accepted recovery limits		

Hall Environmental Analysis Laboratory, Inc.

Date: *28-Dec-09*

CLIENT:	Daniel B. Stephens & Assoc.	**Client Sample ID:**	SVE-3 Pilot @ 1400
Lab Order:	0912453	**Collection Date:**	12/19/2009 2:00:00 PM
Project:	SFCJC	**Date Received:**	12/21/2009
Lab ID:	0912453-03	**Matrix:**	AIR

Analyses	Result	PQL	Qual	Units	DF	Date Analyzed
EPA METHOD 8015B: GASOLINE RANGE						Analyst: **NSB**
Gasoline Range Organics (GRO)	46000	1300		µg/L	250	12/23/2009 2:28:57 PM
Surr: BFB	88.4	76.8-150		%REC	250	12/23/2009 2:28:57 PM
EPA METHOD 8021B: VOLATILES						Analyst: **NSB**
Methyl tert-butyl ether (MTBE)	ND	63		µg/L	250	12/23/2009 2:28:57 PM
Benzene	180	25		µg/L	250	12/23/2009 2:28:57 PM
Toluene	560	25		µg/L	250	12/23/2009 2:28:57 PM
Ethylbenzene	80	25		µg/L	250	12/23/2009 2:28:57 PM
Xylenes, Total	290	75		µg/L	250	12/23/2009 2:28:57 PM
Surr: 4-Bromofluorobenzene	94.5	70.2-105		%REC	250	12/23/2009 2:28:57 PM

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
E	Estimated value	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	MCL	Maximum Contaminant Level
ND	Not Detected at the Reporting Limit	RL	Reporting Limit
S	Spike recovery outside accepted recovery limits		

QA/QC SUMMARY REPORT

Client: Daniel B. Stephens & Assoc.
Project: SFCJC **Work Order:** 0912453

Analyte	Result	Units	PQL	SPK Va	SPK ref	%Rec	LowLimit	HighLimit	%RPD	RPDLimit	Qual
Method: EPA Method 8015B: Gasoline Range											
Sample ID: 5ML RB		*MBLK*				Batch ID:	**R36705**	Analysis Date:	12/23/2009 9:40:57 AM		
Gasoline Range Organics (GRO)	ND	mg/L	0.050								
Sample ID: 2.5UG GRO LCS		*LCS*				Batch ID:	**R36705**	Analysis Date:	12/23/2009 12:54:29 PM		
Gasoline Range Organics (GRO)	0.5104	mg/L	0.050	0.5	0	102	80	115			
Sample ID: 2.5UG GRO LCS		*LCS*				Batch ID:	**R36705**	Analysis Date:	12/23/2009 1:24:58 PM		
Gasoline Range Organics (GRO)	0.5238	mg/L	0.050	0.5	0	105	80	115			
Method: EPA Method 8021B: Volatiles											
Sample ID: 5ML RB		*MBLK*				Batch ID:	**R36705**	Analysis Date:	12/23/2009 9:40:57 AM		
Methyl tert-butyl ether (MTBE)	ND	µg/L	2.5								
Benzene	ND	µg/L	1.0								
Toluene	ND	µg/L	1.0								
Ethylbenzene	ND	µg/L	1.0								
Xylenes, Total	ND	µg/L	2.0								
1,2,4-Trimethylbenzene	ND	µg/L	1.0								
1,3,5-Trimethylbenzene	ND	µg/L	1.0								
Sample ID: 100NG BTEX LCS 1		*LCS*				Batch ID:	**R36705**	Analysis Date:	12/23/2009 9:03:23 PM		
Methyl tert-butyl ether (MTBE)	18.75	µg/L	2.5	20	0	93.8	51.2	138			
Benzene	20.10	µg/L	1.0	20	0	100	85.9	113			
Toluene	19.86	µg/L	1.0	20	0	99.3	86.4	113			
Ethylbenzene	19.74	µg/L	1.0	20	0.08	98.3	83.5	118			
Xylenes, Total	59.57	µg/L	2.0	60	0	99.3	83.4	122			
1,2,4-Trimethylbenzene	19.76	µg/L	1.0	20	0	98.8	83.5	115			
1,3,5-Trimethylbenzene	18.93	µg/L	1.0	20	0	94.6	85.2	113			
Sample ID: 100NG BTEX LCS		*LCS*				Batch ID:	**R36705**	Analysis Date:	12/23/2009 8:33:02 PM		
Methyl tert-butyl ether (MTBE)	19.90	µg/L	2.5	20	0	99.5	51.2	138			
Benzene	20.99	µg/L	1.0	20	0	105	85.9	113			
Toluene	20.73	µg/L	1.0	20	0	104	86.4	113			
Ethylbenzene	20.54	µg/L	1.0	20	0.08	102	83.5	118			
Xylenes, Total	62.65	µg/L	2.0	60	0	104	83.4	122			
1,2,4-Trimethylbenzene	21.02	µg/L	1.0	20	0	105	83.5	115			
1,3,5-Trimethylbenzene	19.73	µg/L	1.0	20	0	98.6	85.2	113			

Qualifiers:

E	Estimated value	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Reporting Limit
R	RPD outside accepted recovery limits	S	Spike recovery outside accepted recovery limits

Hall Environmental Analysis Laboratory, Inc.

Sample Receipt Checklist

Client Name DBS | Date Received: 12/21/2009

Work Order Number 0912453 | Received by: AT

Checklist completed by: Signature 12/21/09 Date | Sample ID labels checked by: Initials 12.21.09

Matrix: | Carrier name Client drop-off

Shipping container/cooler in good condition?	Yes ☑	No ☐	Not Present ☐		
Custody seals intact on shipping container/cooler?	Yes ☐	No ☐	Not Present ☐	Not Shipped ☑	
Custody seals intact on sample bottles?	Yes ☐	No ☐	N/A ☑		
Chain of custody present?	Yes ☑	No ☐			
Chain of custody signed when relinquished and received?	Yes ☑	No ☐			
Chain of custody agrees with sample labels?	Yes ☑	No ☐			
Samples in proper container/bottle?	Yes ☑	No ☐			
Sample containers intact?	Yes ☑	No ☐			
Sufficient sample volume for indicated test?	Yes ☑	No ☐			
All samples received within holding time?	Yes ☑	No ☐			
Water - VOA vials have zero headspace? No VOA vials submitted	☑	Yes ☐	No ☐		
Water - Preservation labels on bottle and cap match?	Yes ☐	No ☐	N/A ☑		
Water - pH acceptable upon receipt?	Yes ☐	No ☐	N/A ☑		

Number of preserved bottles checked for pH: _____

<2 >12 unless noted below.

Container/Temp Blank temperature? *<6° C Acceptable* If given sufficient time to cool.

COMMENTS:

Client contacted _____ Date contacted: _____ Person contacted _____

Contacted by: _____ Regarding: _____

Comments: _____

Corrective Action _____

Chain-of-Custody Record

Client: DBS&A

Mailing Address: 6020 ACADEMY RD NE
ABQ NM 87109

Phone #: 505-822-9400

email or Fax#: TGOLDEN@DBSTEPHENS.COM

QA/QC Package:
☒ Standard ☐ Level 4 (Full Validation)

Accreditation
☐ NELAP ☐ Other _____

☐ EDD (Type) _____

Turn-Around Time:
☒ Standard ☐ Rush _____

Project Name: SFCJC

Project #: ES09.0215.00.SVE.9002

Project Manager: M. McVEY

Sampler: T. GOLDEN

On Ice: ☐ Yes ☒ No

Sample Temperature:

HALL ENVIRONMENTAL ANALYSIS LABORATORY
www.hallenvironmental.com
4901 Hawkins NE - Albuquerque, NM 87109
Tel. 505-345-3975 Fax 505-345-4107

Analysis Request

Date	Time	Matrix	Sample Request ID	Container Type and #	Preservative Type	HEAL No. 092453	BTEX + MTBE + TMB's (8021)	BTEX + MTBE + TPH (Gas only)	TPH Method 8015B (Gas/Diesel)	TPH (Method 418.1)	EDB (Method 504.1)	8310 (PNA or PAH)	RCRA 8 Metals	Anions (F,Cl,NO_3,NO_2,PO_4,SO_4)	8081 Pesticides / 8082 PCB's	8260B (VOA)	8270 (Semi-VOA)					Air Bubbles (Y or N)
12/19/09	0900	AIR	SVE-3 PILOT @ 0900	1@ Tedlar bag	None	-1	X		X													
12/19/09	1130	AIR	SVE-3 PILOT @ 1130	1@ Tedlar bag	None	-2	X		X													
12/19/09	1400	AIR	SVE-3 PILOT @ 1400	1@ Tedlar bag	None	-3	X		X													

Date	Time	Relinquished by:	Received by:	Date	Time
12/21/09	0825			12/21/09	0825
Date:	Time:	Relinquished by:	Received by:	Date	Time

Remarks:

If necessary, samples submitted to Hall Environmental may be subcontracted to other accredited laboratories. This serves as notice of this possibility. Any sub-contracted data will be clearly notated on the analytical report.

QUOTATION #6794

October 21, 2008

Mr. Peter Guerra
AMEC Earth & Environmental, Inc. (505) 821-1801
8519 Jefferson NE
Albuquerque, NM 87113
Re: 300 CFM Thermal Oxidizer

300-CFM Thermal/Catalytic Oxidizer General Specifications

Baker Furnace, Inc. is pleased to present this proposal to **AMEC Earth & Environmental, Inc.** for a Gas Fired 300-CFM Thermal/Catalytic Oxidizer System. This Oxidizer would be constructed as a "turnkey" system ready for operation and would have all the necessary instrumentation and controls to meet applicable Air Quality Standards. We are sure you will find our quality, value and services exceptional!

One (1) **Gas Fired Thermal/Catalytic Oxidizer** rated at **300 SCFM @ 60" H_2O vacuum (100" H_2O maximum vacuum)**. Trailer Mounted System includes a Knock-Out Tank/Entrainment Separator with High Water Level Switch, Site Glass and In-Line Filter, LEL Auto-Dilution Valving based on temperature, Roots 56 URAI P-D Vacuum Blower with 10 hp TEFC 3 Phase Motor, FM Approved Flame Arrester, Air Pressure Switch, Pitot Tube with Pressure Transmitter, Carbon Steel Shell Insulated with High Temperature Insulation with Catalyst "Ready" Design, U.L Classified Nema 4 Control Panel, Eclipse Package Burner with integrated combustion blower, Fully Modulating FM Fuel Train, and misc. Wiring and Piping. Note-Catalytic Cell is offered as an option**.**

300 CFM Thermal/Catalytic Oxidizer Technical Specifications

Parameter	Thermal Mode	Catalytic Mode
Destruction Efficiency	99%+	98%+
Operating Temperature	1450 Degrees F	750 Degrees F
Supplemental Fuel	Propane or Natural Gas	Propane or Natural Gas
Fuel usage at 0% LEL w/ Heat Exch.	400,000 BTU/hr.	175,000 BTU/hr.
Maximum Concentration to Oxidizer	50% of LEL	25% of LEL
Vacuum available	100" H_2O	100" H_2O
Stack Height (Discharge height)	Min. 13.5 feet	Min. 13.5 feet
Exit Velocity	600 feet/min	450 feet/min.
Chart Recorder Measurements	Temperature & Flow	Temp In, Temp Out & Flow
Overall Dimensional Footprint	8.5' wide x 14' long	8.5' wide x 14' long
Approximate Shipping Weight	5,600 lbs.	5,600 lbs.
Inlet Pipe size for VES.	3" N.P.T.	3" N.P.T
Inlet pipe size for Natural Gas/ Propane	1" N.P.T.	1" N.P.T.
Inlet Gas pressure required	5 PSI	5 PSI
Fuel Supply Requirement (Start Up)	750,000 Btu/hr. –800 ft^3/Hr.	350,000 Btu/hr. –400 ft^3/Hr.
Horsepower, VES Blower	10 H.P. @ 100" H_2O	10 H.P. @ 100" H_2O
Electrical Service	230 VAC, 3∅, 60 Amps	230 VAC, 3∅, 60 Amps
Residence Time for Vapors Oxidized	1-second residence time.	N/A

300 CFM Thermal/Catalytic Oxidizer Pricing

Description	Price
300 CFM Trailer Mounted Thermal/Catalytic "Ready" Oxidizer with PD blower (Base Price)	**$46,670.00**
Options	
Catalytic Cell	**$5,100.00**
50% Efficient Stainless Steel Shell and Tube Heat Exchanger – Saves Supplemental Fuel	**$7,100.00**
Auto drain Knockout Tank Pump and Controls	**$1,475.00**
Fully Insulated PD Blower Sound Enclosure, approx 7 dBA reduction to 76 dBA	**$1,700.00**
Sub-Total with all Options	**$62,045.00**

Pricing does not include, Freight, installation or permitting or applicable taxes

- This proposal is valid for 60 days from October 21, 2008.
- Terms: 40% down, 50% at shop completion, 10% net 30 from shipment.
- Shipping Point – EXW, Yorba Linda, CA.
- Delivery - Approximately 10-12 weeks from receipt of Purchase Order and Down Payment.

Additional Technical Specifications

- **VES Blower and Motor:** Roots 56 URAI positive displacement blower connected via pulley/belt system to 10 h.p, TEFC, 3∅, electric motor with adjustable slide base for belt tension adjustments. Estimated noise level with Silence Plus VES blower configuration, ***3 feet*** from source is 76 dBa. Based on Roots modeling, noise level with no silencing options for this blower is 83 dBa. Best practices for silencing will achieve a maximum of 7-10 dBA reduction from bare blower baseline.

- **Combustion Chamber:** Square plate steel with 5" ceramic refractory insulation rated to 1800 ° F. Combustion chamber is sized to provide 1+ seconds residence time and 99%+ DRE in thermal mode at a maximum 300 SCFM.

- **Combustion burner:** Eclipse 1.0 mm BTU/hour package burner with 33:1 turndown and integrated combustion blower. Burner will be fully proportioning for automatic, precise temperature control.

- **Fuel Train:** FM approved fuel train with double blocking valve, inlet gas pressure regulator, high-low gas pressure switch and Eclipse-Dungs proportioning valve.

- **Moisture Knockout Tank:** Nominal **50 gallon** working capacity with corrosion resistant epoxy coating on interior. Standard offering includes high water level shutdown interlock. Auto drain option to include high capacity Ebara stainless steel pump and activation switches. The Ebara pump has proven itself a reliable performer capable of pumping off the knockout tank even at high vacuum levels.

- **Electrical Control Panel:** "True" NEMA 4 rating, U.L. classified as flame control panel and industrial control panel. Panel includes heavy duty, appropriately sized main disconnect.

- **Instrumentation and Controls:** Yokogawa digital paperless chart recorder, Honeywell flame safety, and West digital controllers for process control (temperature and dilution air control) and high temperature shutdown. Baker oxidation systems utilize ***PLC logic*** and feature automatic supplemental fuel modulation (as a function of BTU content of process stream) and **LEL Auto-Dilution Valving based on temperature**, Honeywell Modutrol Drive motor and dilution valve comprised of stainless steel butterfly valve in heavy duty, corrosion proof, PVC housing.

- **Safety Interlocks/Shutdowns:** Standard safety interlocks and shutdowns on all Baker oxidation systems are comprised of High-low gas pressure, VES blower air pressure, high temperature, combustion blower air pressure, high water level in moisture knockout tank and flame failure. In the event any of these interlocks is not met, the oxidizer will not proceed past the limits complete step in the ignition sequence (*flame failure and high temperature are not interlocks in startup sequence*). In the event that any of these interlocks are breached during operation, the main gas valve closes in .3 seconds, the dilution valve closes to wells and VES and combustion blowers shut down after a time out delay to allow for purging of combustion chamber.

- **Third Party Certifications and Approvals:** Baker Furnace, Inc. has the following approvals and certifications (all are current in force and good standing): U.L. Classification files as "Enclosed Industrial Control Panel" and "Enclosed Flame Control Panel", City of Los Angeles Fire Department General Approval and City of Los Angeles Mechanical Testing Laboratory General Approval, SCAQMD Certified Equipment Permit. The Baker Oxidizer as proposed meets the approval guidelines of CSA International.

- **Catalyst:** Baker oxidation systems are "catalytic ready". The catalyst provided for use with a Baker system is platinum bead in a metallic monolith. It is generally recommended that the unit not be converted from thermal to catalytic operation until hydrocarbon levels are below 25% of the LEL (approximately 3,475 ppmv for BTEX). This is the level at which the temperature rise created by the exothermic reaction of the process constituents and the catalyst will not exceed safe catalyst operation levels. *Actual temperature rise across the catalyst is a function of BTU value of constituents. A significant risk of catalyst de-activation is associated with processing of high sulphur content diesel, chlorinated or fluorinated compounds.*

Installation, Start-Up and Training

Baker Furnace, Inc. can provide onsite field assistance at the rate of $1,050.00/day plus per diem expenses (Per diem expenses are marked up 20%).

Equipment Warranty

Baker Furnace, Inc.'s Standard Warranty guarantees that all equipment manufactured by **Baker Furnace, Inc.** will be free from defects in materials and workmanship for a period of twelve (12) months from the date of completion. Components and/or sub-assemblies not manufactured by **Baker Furnace, Inc.** will be covered by each individual warranty; typically twelve (12) months in length from the date of manufacturing completion. **Baker Furnace, Inc.** will replace warranted components that may fail within the designated warranty period at "No Charge". All warranted parts are FOB factory.

Operation Manual

An operation manual, with complete documentation will be provided with instructions detailing how to install, operate, and maintain the Baker Oxidizer and its ancillary equipment.

Thank you for the opportunity to quote **AMEC Earth & Environmental, Inc.** on this project. If you have any questions or would like additional information, please don't hesitate to contact me. We look forward to hearing from you

Best Regards,

Gary Gorman
Baker Furnace, Inc.

Baker Furnace, Inc.

ROOTS BLOWER PERFORMANCE SUMMARY : North Main, Las Cruces

AMBIENT CONDITIONS:

Gas	AIR	
Relative Humidity	36%	
Molecular Weight	28.842	
k-Value	1.396	
Specific Gravity	.996	
Ambient Temperature	68	deg F
Ambient Pressure	12.73	PSIA
Elevation	3900	feet

STANDARD CONDITIONS:

Pressure	14.7	PSIA
Temperature	68	deg F
Relative Humidity	36	%

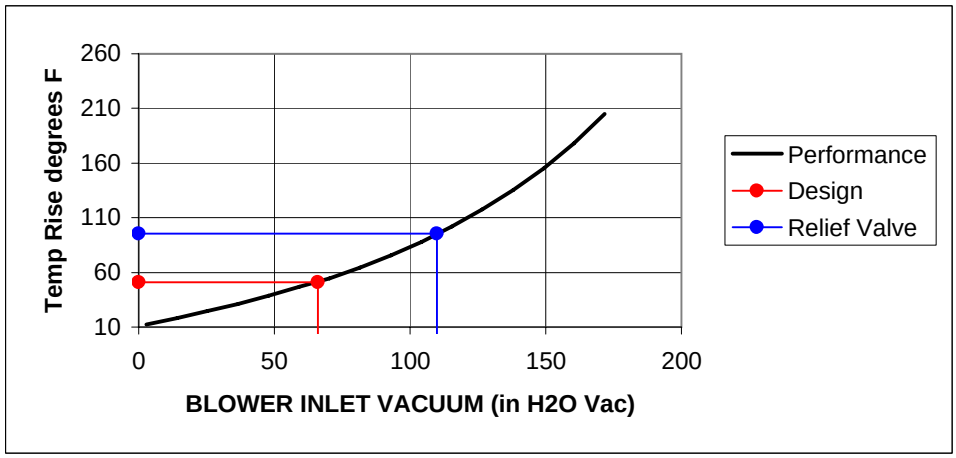
INPUT CONDITIONS:

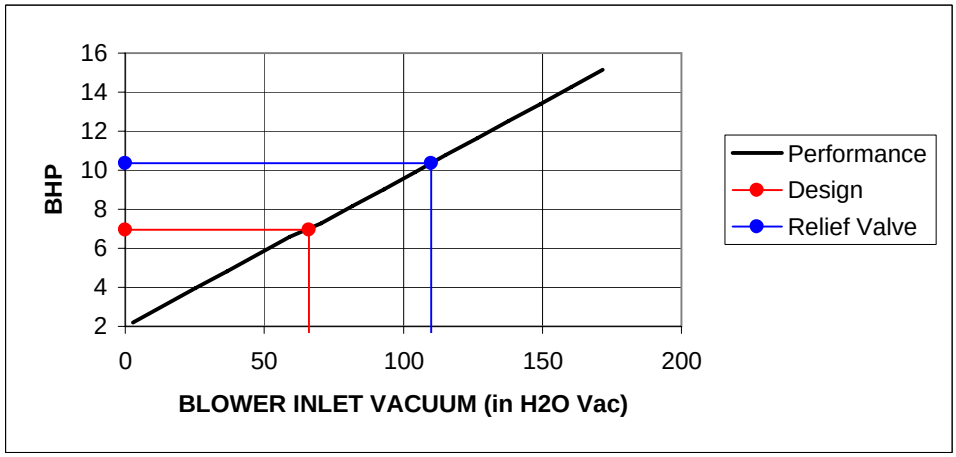
Actual Inlet Volume	428	ICFM	+/-5 %
Standard Volume	300	SCFM	
Mass/Weight Flow	23.02	#/min	+/-5 %
System Inlet Pressure	60	in H2O Vac	
Inlet Pressure Loss	6	in H2O	
Blower Inlet Pressure	10.35	PSIA	
System Discharge Pressure	12.73	PSIA	
Discharge Pressure Loss	18	in H2O	
Blower Discharge Pressure	13.38	PSIA	
Inlet Temperature	68	deg F	

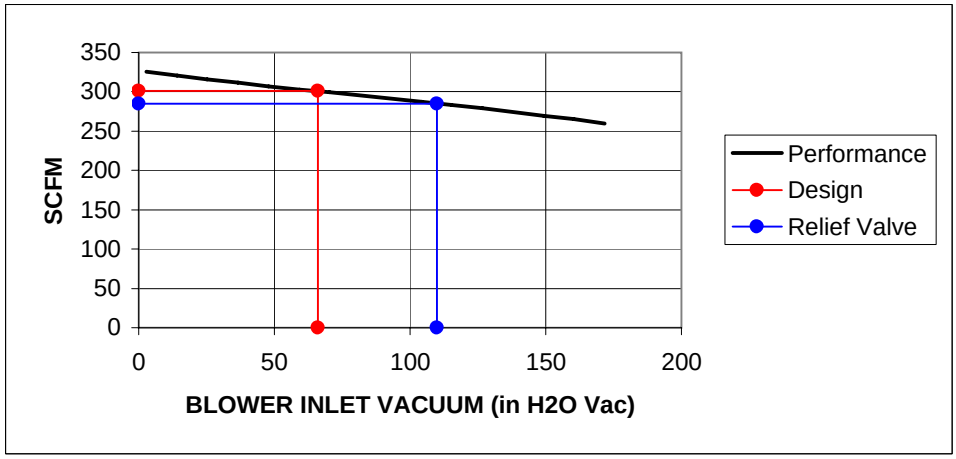
SELECTED UNIT DETAIL:

Model	56	URAI	
Speed	2231	RPM	78%
Blower Differential Pressure	3.03	PSI	23%
Power at Blower Shaft	6.9	BHP +/- 4%	
Temperature Rise	51	deg F	23%
Discharge Temperature	119	deg F	
Discharge Volume	362	ACFM	
Relief Valve Setting	110	in H2O Vac	59%
Power at the relief valve Setting	10.8	BHP +/- 4%	
Temp. Rise at the Relief Valve Setting	97	deg F	43%
Discharge Temp At Relief Valve Setting	165	deg F	
Gear Tip Speed	2923	FPM	
V-Belt: Est. B10 Brg Life:	9348462	hours	
Coupling: Est. B10 Brg Life:	9348462	hours	
Est. Free Field Noise @ 1 m.	83.6	dBa	
CFR	0.221		
Weight	170	lbs.	
Shaft Dia.	1.125	in.	
Min. Sheave Dia.	6	in.	
Inlet/Disch Conn.	4T		

Dresser Roots
56 URAI: Variable Pressure Performance

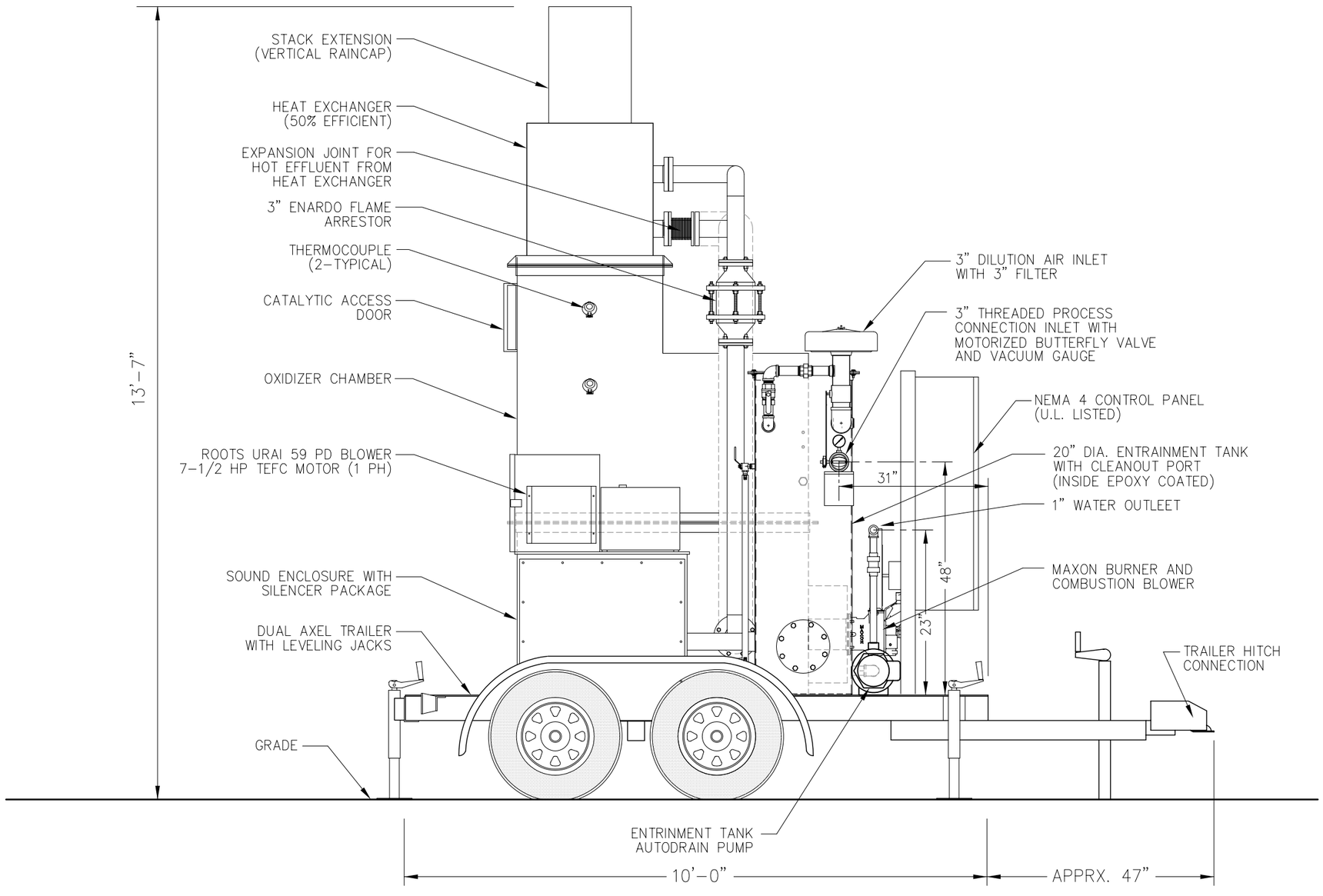






Customer : AMEC
Project : North Main, Las Cruces

INLET CONDITIONS: AIR
RH = 36.00%, MW = 28.842, k = 1.396, Tin = 68 deg F
DESIGN: Speed = 2231 RPM
System Inlet P = 60 in H2O Vac, Inlet P Loss = 6 in H2O
System Disch P = 12.73 PSIA, Disch P Loss = 18 in H2O
RELIEF VALVE PRESSURE: = 110 in H2O Vac



ELEVATION OR PROFILE VIEW

NO.	DATE	BY	REVISION
1			
2			
3			
4			

APPROVAL RECORD

SIGNATURE		DATE
MECH ENG		
ELECT ENG	GARY GORMAN	9/12/06
PROJ MANAGER:	ERNIE BACON	9/12/06
DESIGNED BY:	BACON/DEE/GORMAN	9/12/06
DRAWN BY:	ED DEE	9/12/06
APPROVED BY:		

SCALE: NOT TO SCALE | SIZE: BSIZE (17 X 11)

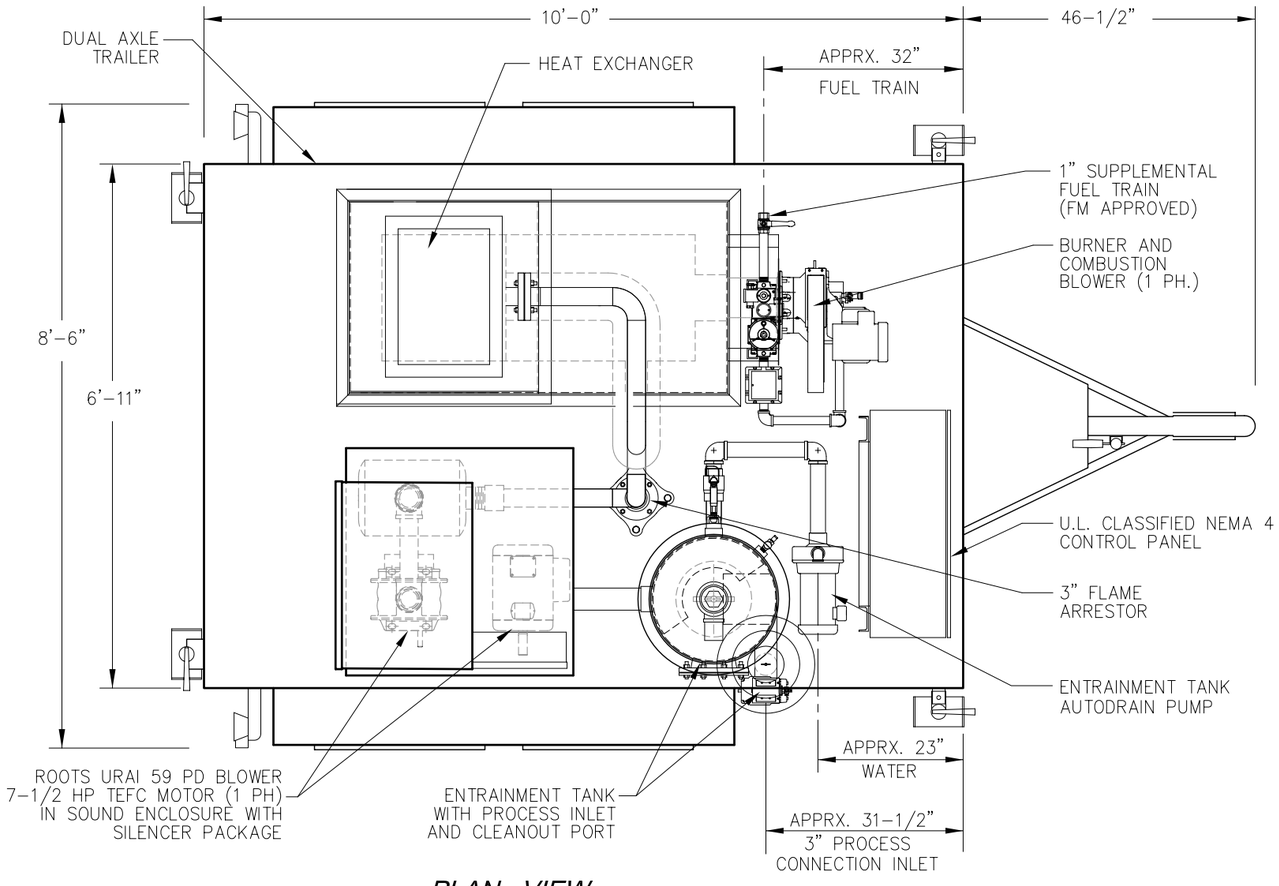
OPTIMIZER 250 SCFM THERMAL / CATALYTIC OXIDIZER

ELEVATION VIEW

DATE: 9/13/2006 | FILE:

PROJECT NO:

BAKER FURNACE INC.



PLAN VIEW

NO.	DATE	BY	REVISION
1			
2			
3			
4			

APPROVAL RECORD

SIGNATURE		DATE
MECH ENG		
ELECT ENG	GARY GORMAN	9/12/06
PROJ MANAGER:	ERNIE BACON	9/12/06
DESIGNED BY:	BACON/DEE/GORMAN	9/12/06
DRAWN BY:	ED DEE	9/12/06
APPROVED BY:		

SCALE: NOT TO SCALE

SIZE: BSIZE (17 X 11)

OPTIMIZER 250 SCFM THERMAL / CATALYTIC OXIDIZER

PLAN VIEW

DATE: 9/13/2006

FILE:

PROJECT NO:

BAKER FURNACE INC.

Section 8

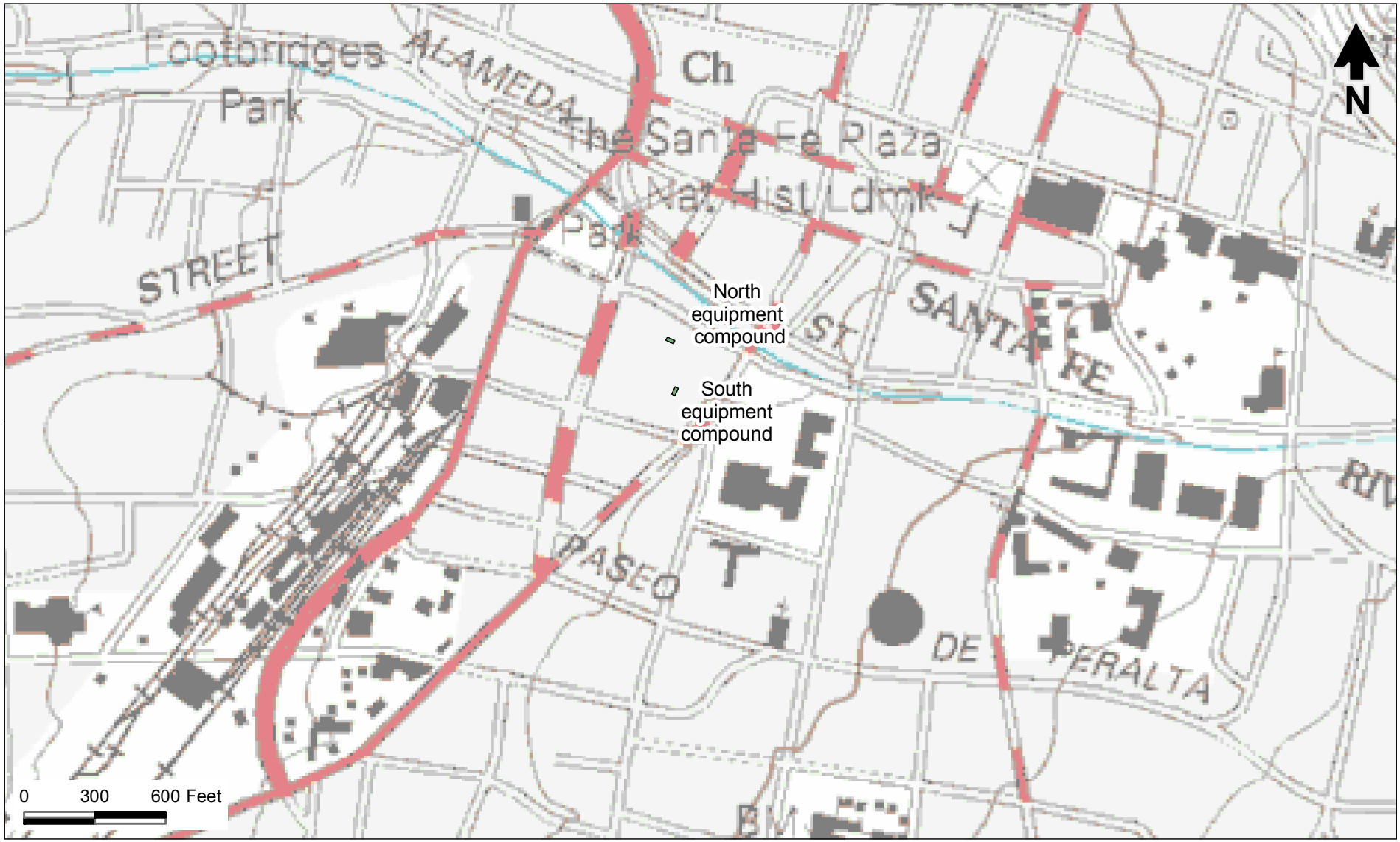
Map(s)

A map such as a 7.5 minute topographic quadrangle showing the exact location of the source. The map shall also include the following:

The UTM or Longitudinal coordinate system on both axes	An indicator showing which direction is north
A minimum radius around the plant of 0.8km (0.5 miles)	Access and haul roads
Topographic features of the area	Facility property boundaries
The name of the map	The area which will be restricted to public access
A graphical scale	

Please see the topographic map on the next page.

S:/PROJECTS/ES09.0215_SFCJC/GIS/MXDS/REPORTS/FRP/TOPO_MAP_FOR_AQB_PERMIT.MXD 012120



Explanation

Equipment Compounds

Sources: USGS Santa Fe Quadrangle
7.5-Minute Series dated 1993

SANTA FE COUNTY JUDICIAL COMPLEX

Topographic Map

Daniel B. Stephens & Associates, Inc.
02/12/2010
JN ES09.0215

Section 9

Proof of Public Notice

(for NSR applications submitting under 20.2.72 or 20.2.74 NMAC)
(This proof is required by: 20.2.72.203.A.14 NMAC "Documentary Proof of applicant's public notice")

X I have read the AQB "Guidelines for Public Notification for Air Quality Permit Applications"
This document provides detailed instructions about public notice requirements for various permitting actions. It also provides public notice examples and certification forms. Material mistakes in the public notice will require a re-notice before issuance of the permit.

Unless otherwise allowed elsewhere in this document, the following items document proof of the applicant's Public Notification. Please include this page in your proof of public notice submittal with checkmarks indicating which documents are being submitted with the application.

New Permit and **Significant Permit Revision** public notices must include all items in this list.

Technical Revision public notices require only items 1, 5, 9, and 10.

Per the Guidelines for Public Notification document mentioned above, include:

1. ☐ A copy of the certified letter receipts with post marks (20.2.72.203.B NMAC)
2. ☐ A list of the places where the public notice has been posted in at least four publicly accessible and conspicuous places, including the proposed or existing facility entrance. (e.g: post office, library, grocery, etc.)
3. ☐ A copy of the property tax record (20.2.72.203.B NMAC).
4. ☐ A sample of the letters sent to the owners of record.
5. ☐ A sample of the letters sent to counties, municipalities, and Indian tribes.
6. ☐ A sample of the public notice posted and a verification of the local postings.
7. ☐ A table of the noticed citizens, counties, municipalities and tribes and to whom the notices were sent in each group.
8. ☐ A copy of the public service announcement (PSA) sent to a local radio station and documentary proof of submittal.
9. ☐ A copy of the classified or legal ad including the page header (date and newspaper title) or its affidavit of publication stating the ad date, and a copy of the ad. When appropriate, this ad shall be printed in both English and Spanish.
10. ☐ A copy of the display ad including the page header (date and newspaper title) or its affidavit of publication stating the ad date, and a copy of the ad. When appropriate, this ad shall be printed in both English and Spanish.
11. ☐ A map with a graphic scale showing the facility boundary and the surrounding area in which owners of record were notified by mail. This is necessary for verification that the correct facility boundary was used in determining distance for notifying land owners of record.

The required public notice items will be completed upon approval of the final remediation plan by the PSTB.

Section 10

Written Description of the Routine Operations of the Facility

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A written description of the routine operations of the facility. Include a description of how each piece of equipment will be operated, how controls will be used, and the fate of both the products and waste generated. For modifications and/or revisions, explain how the changes will affect the existing process. In a separate paragraph describe the major process bottlenecks that limit production. The purpose of this description is to provide sufficient information about plant operations for the permit writer to determine appropriate emission sources.

The SVE system startup will require daily site visits for the first three to five days of operation to document system performance and hydrocarbon recovery rates. During this initial startup period the SVE system will be adjusted to obtain optimum performance.

Applied vacuum and resultant flow rates and vapor concentrations will be measured in each individual SVE well. Vacuum and fluid levels in surrounding wells will be observed to determine the ROI for each treatment well.

The above data will allow implementation of a remediation system operational schedule consisting of alternating well configurations to maximize hydrocarbon removal from the site.

Section 11

PSD Applicability Determination for All Sources

(Submitting under 20.2.72, 20.2.74 NMAC)

A PSD applicability determination for all sources. For sources applying for a significant permit revision, apply the applicable requirements of 20.2.74 NMAC to determine whether this facility is a major or minor PSD source, and whether this modification is a major or a minor PSD modification. It may be helpful to refer to the procedures for Determining the Net Emissions Change at a Source as specified by Table A-5 (Page A.45) of the EPA New Source Review Workshop Manual to determine if the revision is subject to PSD review.

A. This facility is:

- **X** **a minor source before and after this modification (if so, delete C and D below).**
- ☐ **a major source before this modification. This modification will make this a PSD minor source.**
- ☐ **an existing PSD Major Source that has never had a major modification requiring a BACT analysis.**
- ☐ **an existing PSD Major Source that has had a major modification requiring a BACT analysis**
- ☐ **a new PSD Major Source after this modification.**

B. **This facility is not one of the listed 20.2.74.501 Table I – PSD Source Categories. The "project" emissions for this modification are not significant, because the emissions (2 ton/year) are less than the threshold value established by the NMED of 25 ton/year. The "project" emissions listed below do not only result from changes described in this permit application, thus no emissions from other [revisions or modifications, past or future] to this facility. Also, specifically discuss whether this project results in "de-bottlenecking", resulting in higher emissions. The project emissions (before netting) for this project are as follows:**

a. **NOx: 0 TPY**
b. **CO: 0 TPY**
c. **VOC: 2 TPY**
d. **SOx: 0 TPY**
e. **PM: 0 TPY**

C. **Netting is not required because the project is not significant.**
D. **BACT is not required for this modification, as the project is not significant.**
E. If this is an existing PSD major source, or any facility with emissions greater than 250 TPY (or 100 TPY for 20.2.74.501 Table 1 – PSD Source Categories), determine whether any permit modifications in the last two years were related, or could be considered a single project with this action, and provide an explanation for your determination whether a PSD modification is triggered.

This is a minor source; therefore it is not subject to 20.2.74 NMAC (Prevention of Significant Deterioration).

Section 12

Special Requirements for a PSD Application

(Submitting under 20.2.74 NMAC)

Prior *to Submitting a PSD application,* **the permittee shall:**

- ☐ Submit the BACT analysis for review prior to submittal of the application. No application will be ruled complete until the final determination regarding BACT is made, as this determination can ultimately affect information to be provided in the application. A pre-application meeting is recommended to discuss the requirements of the BACT analysis.
- ☐ Submit a modeling protocol prior to submitting the permit application**.**
- ☐ Submit the monitoring exemption analysis protocol prior to submitting the application.

For PSD applications, the permittee shall also include the following:

- ☐ Documentation containing an analysis on the impact on visibility.
- ☐ Documentation containing an analysis on the impact on soil.
- ☐ Documentation containing an analysis on the impact on vegetation, including state and federal threatened and endangered species.
- ☐ Documentation containing an analysis on the impact on water consumption and quality.
- ☐ Documentation that the federal land manager of a Class I area within 100 km of the site has been notified and provided a copy of the application, including the BACT and modeling results. The name of any Class I Federal area located within one hundred (100) kilometers of the facility.

This is a minor source; therefore it is not subject to 20.2.74 NMAC (Prevention of Significant Deterioration).

Section 13

Discussion Demonstrating Compliance With Each Applicable State & Federal Regulation

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Provide a discussion demonstrating compliance with applicable state & federal regulation. If there is a state or federal regulation (other than those listed here) for your facility's source category that does not apply to your facility, but seems on the surface that it should apply, add the regulation to the appropriate table below and provide the analysis. Examples of regulatory requirements that may or may not apply to your facility include 40 CFR 60 Subpart OOO (crushers), 40 CFR 63 Subpart HHH (HAPs), or 20.2.74 NMAC (PSD major sources). We don't want a discussion of every non-applicable regulation, but if there is questionable applicability, explain why it does not apply. All input cells should be filled in, even if the response is 'No' or 'N/A'.

If this application includes any proposed exemptions from otherwise applicable requirements, provide a narrative explanation of these proposed exemptions. These exemptions are from specific applicable requirements, which are spelled out in the requirements themselves, not exemptions from 20.2.70 NMAC or 20.2.72 NMAC.

Example of a Table for Applicable STATE REGULATIONS:

STATE REGU-LATIONS CITATION	Title	Applies to Entire Facility	Applies to Unit No(s).	Federally Enforce-able	Does Not Apply	JUSTIFICATION:
20.2.3 NMAC	Ambient Air Quality Standards NMAAQS	Yes	N/A	No		This facility burns gasoline, which has the potential to produce small amounts of Sulfur Compounds, Carbon Monoxide or Nitrogen Dioxide.
20.2.7 NMAC	Excess Emissions	No	N/A	No	N/A	This facility is a minor source, not a Title V source.
20.2.33 NMAC	Gas Burning Equipment - Nitrogen Dioxide	No	N/A	No	N/A	This facility uses new gas burning equipment, but only thermal oxidizers with a combined maximum heat input of less than 83,300 million metric BTU per year, which is less than the threshold 1,000,000 million metric BTU per year per unit.
20.2.61.109 NMAC	Smoke & Visible Emissions	No	N/A	No	N/A	This facility is not subject because it qualifies for exemption D under 20.2.61.111 NMAC.
20.2.70 NMAC	Operating Permits	No	N/A	No	N/A	This facility is not subject because it qualifies for exemption B under 20.2.70.202 NMAC (non-major source).
20.2.71 NMAC	Operating Permit Fees	No	N/A	No	N/A	This facility is not subject because it qualifies for exemption B under 20.2.70.202 NMAC (non-major source).
20.2.72 NMAC	Construction Permits	No	N/A	No	N/A	This facility is not subject to 20.2.72 NMAC because it does not meet any of the permit requirements.
20.2.73 NMAC	NOI & Emissions Inventory Requirements	No	N/A	No	N/A	The emissions from this facility are low enough that an NOI is not required.
20.2.75 NMAC	Construction Permit Fees	No	N/A	No	N/A	This facility is not subject to 20.2.72 NMAC because it does not meet any of the permit requirements.
20.2.77 NMAC	New Source Performance	No	N/A	No	N/A	This facility is a Clean Air Act designated area source which is not regulated by the EPA under 40 CFR 60.
20.2.78 NMAC	Emission Standards for HAPS	No	N/A	No	N/A	This facility is a Clean Air Act designated area source which is not regulated by the EPA under 40 CFR 61 or by the Urban Air Toxics Strategy.

STATE REGULATIONS CITATION	Title	Applies to Entire Facility	Applies to Unit No(s).	Federally Enforceable	Does Not Apply	JUSTIFICATION:
20.2.80 NMAC	Stack Heights	No	1,2,3	No		This facility has a stack with each piece of SVE equipment.
20.2.82 NMAC	MACT Standards for source categories of HAPS	No	N/A	No	N/A	This facility is a Clean Air Act designated area source which is not regulated by the EPA under 40 CFR 61 or by the Urban Air Toxics Strategy.

Example of a Table for Applicable FEDERAL REGULATIONS (Note: This in not an exhaustive list):

FEDERAL REGULATIONS CITATION	Title	Applies to Entire Facility	Applies to Unit No(s).	Federally Enforceable	Does Not Apply	JUSTIFICATION:
40 CFR 50	NAAQS	Yes	N/A	No		This facility burns gasoline, which has the potential to produce small amounts of Sulfur Compounds, Carbon Monoxide or Nitrogen Dioxide, making it subject to 40 CFR 50.4, 50.5, 50.8, 50.9, 50.10, 50.11, and 50.12.
NSPS 40 CFR 60, Subpart A	General Provisions	No	N/A	No	N/A	This facility is not regulated under 40 CFR 60.
NESHAP 40 CFR 61 Subpart A	General Provisions	No	N/A	No	N/A	This facility is not regulated under 40 CFR 61.
NESHAP 40 CFR 61 Subpart V	National Emission Standards for **Equipment Leaks** (Fugitive Emission Sources)	No	N/A	No	N/A	This facility is a Clean Air Act designated area source which is not regulated by the EPA under 40 CFR 61 or by the Urban Air Toxics Strategy. This facility does not have any equipment in VHAP service.
MACT 40 CFR 63, Subpart A	General Provisions	No	N/A	No	N/A	This facility is a Clean Air Act designated area source which is not regulated by the EPA under 40 CFR 63 or by the Urban Air Toxics Strategy.

Section 14

Operational Plan to Mitigate Emissions

(submitting under 20.2.70, 20.2.72, 20.2.74 NMAC)

☐ **Title V Sources** (20.2.70 NMAC)**:** By checking this box and certifying this application the permittee certifies that it has developed an **Operational Plan to Mitigate Emissions During Startups, Shutdowns, and Emergencies** defining the measures to be taken to mitigate source emissions during startups, shutdowns, and emergencies as required by 20.2.70.300.D.5(f) and (g) NMAC. This plan shall be kept on site to be made available to the Department upon request. This plan should not be submitted with this application.

☐ **NSR** (20.2.72 NMAC)**, PSD** (20.2.74 NMAC) **& Nonattainment** (20.2.79 NMAC) **Sources:** By checking this box and certifying this application the permittee certifies that it has developed an **Operational Plan to Mitigate Source Emissions During Malfunction, Startup, or Shutdown** defining the measures to be taken to mitigate source emissions during malfunction, startup, or shutdown as required by 20.2.72.203.A.5 NMAC. This plan shall be kept on site to be made available to the Department upon request. This plan should not be submitted with this application.

☐ **Title V** (20.2.70 NMAC)**, NSR** (20.2.72 NMAC)**, PSD** (20.2.74 NMAC) **& Nonattainment** (20.2.79 NMAC) **Sources:** By checking this box and certifying this application the permittee certifies that it has established and implemented a Plan to Minimize Emissions During Routine or Predictable Startup, Shutdown, and Scheduled Maintenance through work practice standards and good air pollution control practices as required by 20.2.7.14.A and B NMAC. This plan shall be kept on site or at the nearest field office to be made available to the Department upon request. This plan should not be submitted with this application.

The operational plan to mitigate emissions is cover normal operations, startup, shutdown, and emergencies. Each SVE unit used as part of this facility will be wired such that if any piece of the process fails, the entire system will be shut down. This includes blower failure, natural gas service failure, thermal oxidizer or accelerator failure, and out of acceptable temperature range in the furnace. Alarms on any of these components will shut the entire system down and it will need to be restarted manually.

Section 15

Alternative Operating Scenarios

(submitting under 20.2.70, 20.2.72, 20.2.74 NMAC)

Alternative Operating Scenarios: Provide all information required by the department to define alternative operating scenarios. This includes process, material and product changes; facility emissions information; air pollution control equipment requirements; any applicable requirements; monitoring, recordkeeping, and reporting requirements; and compliance certification requirements. Please ensure applicable Tables in this application are clearly marked to show alternative operating scenario.

There are no alternative operating scenarios for this facility.

Section 16

Air Dispersion Modeling

(submitting under 20.2.72 and 20.2.74 NMAC)

Provide an air quality **dispersion modeling** demonstration (if applicable) as outlined in the Air Quality Bureau's Dispersion Modeling Guidelines. If air dispersion modeling has been waived for this permit application, attach the AQB Modeling Section modeling waiver documentation.

SSM Modeling: Applicants must conduct dispersion modeling for the total short term emissions using realistic worst case scenarios following guidance from the Air Quality Bureau's dispersion modeling section. Refer to "Guidance for Submittal of Startup, Shutdown, Maintenance Emissions in Permit Applications (http://www.nmenv.state.nm.us/aqb/permit/app_form.html) for more detailed instructions on SSM emissions modeling requirements.

Title V: Applications must specify the NSR Permit number for which air quality dispersion modeling was last submitted. Title V applications first (no previous NSR permit with modeled SSM emissions) reporting SSM emissions may require modeling to demonstrate compliance with standards. In this case, either submit modeling or obtain a written modeling waiver.

Air quality dispersion modeling is not required for this facility.

Section 17

Compliance Test History

(submitting under 20.2.70, 20.2.72, 20.2.74 NMAC)

To show compliance with existing NSR permits conditions, you must submit a compliance test history. The table below provides an example.

This facility does not have any existing NSR permits.

Section 20

Other Relevant Information

Other relevant information. Use this attachment to clarify any part in the application that you think needs explaining. Reference the section, table, column, and/or field. Include any additional text, tables, calculations or clarifying information.

Additionally, the applicant may propose specific permit language for AQB consideration. In the case of a revision to an existing permit, the applicant should provide the old language and the new language in track changes format to highlight the proposed changes. If proposing language for a new facility or language for a new unit, submit the proposed operating condition(s), along with the associated monitoring, recordkeeping, and reporting conditions. In either case, please limit the proposed language to the affected portion of the permit.

There is no additional information that needs to be included for this application.

Section 22: Certification

Company Name: _____

I, _____, hereby certify that the information and data submitted in this application are true and as accurate as possible, to the best of my knowledge and professional expertise and experience.

Signed this ____ day of _____, _____, upon my oath or affirmation, before a notary of the State of

_____.

_____ _____
*Signature Date

_____ _____
Printed Name Title

Scribed and sworn before me on this ____ day of _____, _____.

My authorization as a notary of the State of _____ expires on the

_____ day of _____, _____.

_____ _____
Notary's Signature Date

_____
Notary's Printed Name

*For Title V applications, the signature must be of the Responsible Official as defined in 20.2.70.7.AD NMAC.

Appendix E2

Building Permits

Building Permits

Annexation Areas/ Presumptive City Limits
2008 Permit Fees
Building Permit Checklists
Codes
Forms
Interactive Map
Monthly Permit Activity
Questions and Walk Ins
Permit Status
Zoning Verification Requests
Preliminary Zoning Review

The Building Permit Division is responsible for providing building, health and safety standards for the City of Santa Fe through public information, building plan review and permit services. Issuing building permits for new construction and for additions or alterations to existing buildings is one of the key functions of the Building Permit Division.

The Building Permit Division also issues separate Plumbing, Mechanical and Electrical permits for the installation, repair and/or replacement of equipment and systems within the City jurisdiction.

Contact
Yolanda Cortez
Director
Email

Ph: (505) 955-6830
Fx: (505) 955-6829

Hours
8:00 am - 5:00 pm
Monday - Friday
Building and Zoning Walk Ins (Questions)

CALENDAR View All

Nov. 27, 2009 - Jan. 8, 2010 "Stocking Stuffer" Sale at Convention Center Gallery
Jan. 6 Public Utilities Committee
Jan. 7 Airport Advisory Board

QUICK LINKS View All

- NM Construction Industries Division
- Santa Fe Area Home Builders Association
- Home Energy Rating System--- H E R.S Rating Program
- Bldg. Permit Checklist & Forms
- Banners

FAQS View All

Do I need a building permit to build a porch?
What is the status of my building permit?
What is a Commercial "IPSP" and when is it needed?

Forms

Below are sample forms related to your project, some forms have been altered to prevent copying. Come by our offices and fill required forms as needed.

Form A- Address Request
Form B- Water Budget Allocation Approval Form
Form C- Public Works Application for legal access from private to public right of way (curb cut etc.)
Form D- Historic legal clearance requirement letter (To be completed by Historic Dept.)
Form E- To be used in Escarpment Districts only
Form G- Requirements for Fire Protection Services Report (hydrants, sprinklers, gpm's etc.)
From H- Affidavit for Construction of a Guesthouse
Form I- Affidavit restricting use of proposed Accessory Structure
Form J- Building Setback Affidavit
Form L- Prairie Dog inspection/relocation memo (To be reviewed by Technical review Division)
Form N- Water meter size or change-Non Residential Developments (Water Division)
Form O- Architectural evaluation design point system-Commercial-

Annexation Areas/ Presumptive City Limits
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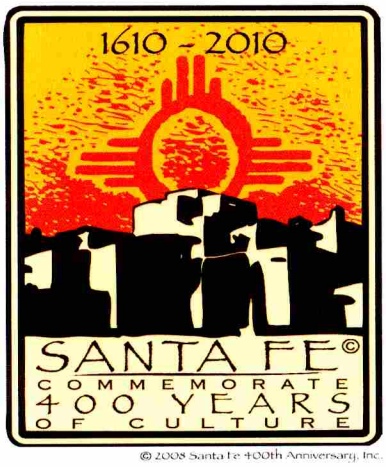
Preliminary Zoning Review



City of Santa Fe

Commercial New Construction Building Permit Application Checklist

Completed Applications are accepted Monday through Friday 8:00 a.m. to 12:00 p.m. and 1:00 p.m. through 5:00 p.m. by the Building Permit Division located at 200 Lincoln Avenue, Santa Fe, New Mexico, 87504. Questions may be directed in person or by phone. (505) 955 6588. Checklist available at www.santafenm.gov

Applications will be accepted only after full completion of the items herein once verified by the City Building Permit Specialist. Contents herein are minimum compliance requirements for applicable federal, state and local ordinances and standards including the 2006 New Mexico Commercial Code. For specifics, contact a Building Plan Reviewer at (505) 955-6588.

PRE-REQUISITE APPROVALS: The following pre-requisite approvals must accompany the building permit application: (if applicable)

- ☐ Address Issuance or Verification - Form A
- ☐ Final Board or Committee Action Including Filing of Appropriate Documents, Plats and Development Plans
- ☐ Water Budget Approval – Form B
- ☐ Driveway Permit – Form C
- ☐ Floodplain Verification (if applicable) – Technical Review Division
- ☐ Historic Preservation District Approval – Form D
- ☐ Escarpment Overlay District Approval – Form E
- ☐ Archeological Clearance Permit – Historic Preservation Division
- ☐ Fire Protection Service Requirement Approval – Form G
- ☐ Prairie Dog Clearance – Form L
- ☐ Waste Water Utility Expansion Charge Approval – Form N
- ☐ Evaluation Form for Architectural Design – Form O

MINIMUM SUBMITTALS/BUILDING PERMIT APPLICATION

Four (4) complete sets of proposed construction plans, pre-requisite compliance documents, and information described below:

_____**1. Building Permit Application:** Complete all required fields and answer all questions. Blue or Black ink only.

_____**2. Legal Lot of Record:** City approved subdivision plat. In the absence of an approved plat, provide a warranty deed and/or survey dated pre 1962 describing the meets and bounds of the property.

_____**3. Property Location/Vicinity Map**: Depict nearest street intersections and north arrow. May be placed on the site plan.

_____**4. Development Plan (if applicable)**: City approved with signatures and Santa Fe County recording data.

_____**5. Title Page:**

a. Project street address and Building/Suite number
b. Project name and tenant name
c. Project size and type
d. Fundamental building code design information, including Type of Construction, Occupancy Group, Occupant Loads, number of stories, floor areas in square feet, whether or not the space/building is equipped with a fire sprinkler system and whether or not there exists such elements as area separation walls (fire walls), occupancy separations (applicable to mixed occupancy), and horizontal exits (a wall constructed for a two-hour occupancy separation, providing a smoke-proof enclosure)
e. Egress/Life Safety Plan, including travel distances, rated wall locations, exit locations and overall key plans
f. Building height and area modifications
g. Effective Building Codes, in accordance with the City of Santa Fe's Ordinances
h. Provide complete name, address and telephone number of person or firm submitting the building plans, including the seal and signature of the Registered Design Professional.

_____**6. Site Plan:** (**Minimum scale 1"=20'**)

a. North arrow
b. Official property address
c. Zone district and proposed use of property
d. Street names
e. Lot Dimensions, meets and bounds
f. Lot area and acreage
g. Existing and proposed improvements
h. Setbacks: Label distances from all existing and proposed structures to property lines and distances between multiple buildings. Include roof overhangs, portals, trellis structures, posts, columns, canopies, sidewalks, and patios.
i. Parking layout. (*Reference Article 14-8.6 SFCC)*
   1) Table demonstrating required parking including formulas and calculations. *NOTE: Net Leasable is gross building area minus bathrooms, mechanical rooms and stairwells.*
   2) Type, size, and dimension of parking spaces, back up aisle and vehicle maneuverability.

3) Ingress/egress
4) Parking barriers
5) Spaces for Disabled, ramps, and signage
6) Parking lot construction
7) Slopes/contours
8) Bicycle spaces
9) Loading docks
10) Ground mounted equipment screening
11) Fire hydrants, if any
12) Interior landscape islands

j. On-site building mounted and parking lot lighting. A separate isometric plan may be necessary.
k. Easements including any and all encumbrances; access, public utility, private, etc.
l. Existing and proposed impervious areas
m. Existing and proposed wall and fences
n. Required open space and landscape areas
o. Flood zones and other drainage discharges
p. Label pre-existing structures, driveways, etc. as **"EXISTING";** label all proposed development **"PROPOSED".**

_____7. Landscape Plan (Minimum scale 1"=20") *(Article 14-8.4 SFCC)*

a. Location, quantity, sizes and botanical names of all plant materials.
b. Location and description of walls, fences, mulches, etc.
c. Common open space
d. Automatic irrigation system, if applicable

_____8. Terrain Management Requirements (if applicable):

☐ **Minor Development Project.** All of the following four criteria must exist for a project to be considered "Minor Development". *(Article 14-8.2, SFCC 1987).*

1. No more than 3,500 square feet of new impervious surface proposed;
2. No more than 5,000 square feet of total disturbance on the legal lot;
3. No more than 10% slopes disturbed, and
4. Drainage pattern is maintained (any new impervious surface means that the drainage pattern is NOT maintained).

Grading and Drainage Plan (Minimum scale 1"=20') must include:

- Location of all impervious surfaces with square footage identified;
- Calculation of storm water requirement. New impervious surface square footage multiplied by 16% (.16) equals the cubic feet of storage required;
- Stormwater storage capacity based on the calculation above. Detention pond, retention pond, infiltration device, active water harvesting or passive water harvesting are all acceptable;

- Sufficient topographic information to show that there are no slopes greater than 10% disturbed. Include sea level datum at two foot contour intervals. This can be obtained from the City's interactive website;
- If a retaining wall or yard wall is proposed, the top and bottom of wall elevations must be included along with the soil elevation on each side of the wall;
- One percent (1%) chance event floodplain (100 year floodplain) if located on the legal lot. This must be stamped and sealed by a licensed New Mexico surveyor and must be based on the best available data.
- All proposed grading, new final contours, slope limits, spot elevations including all surfaces as per *(Article 14-8.2, SFCC 1987);*
- All easements.
- Erosion protection of all disturbed areas indicating methods to be used *(Article 14-8.2, SFCC 1987).*

☐ **All Other Development Projects:** Projects not meeting the four criteria above for "Minor Development" are classified as "All Other Development" *(Article 14-8.2, SFCC 1987).* All "Other Development" projects require a separate grading permit if doing any earthwork more than clearing and grubbing. *(Article 14-3.10(E)SFCC)* A separate building permit application will be required for grading with the same set of submittal drawings as the structural building permit. The same form is used, but application type is labeled by the Building Permit Specialist as "GRAD".

Grading and Drainage Plan (Minimum scale 1"=20') must include:

- Calculation of stormwater requirement stamped and signed by a licensed New Mexico Engineer. All calculations are to be based on the pre and post development 1% chance event (100% year storm). The applicant will be required to provide on-site storage for the difference between the pre and post development run off;
- Stormwater storage capacity based on the engineer's calculations. Detention pond, retention pond and infiltration device are all acceptable for All Other Development;
- Proof that the stormwater will dissipate within 24 hours must be included on the plan;
- One Percent (1%) chance event floodplain (100 year floodplain) if located on the legal lot. Must be stamped and sealed by a licensed New Mexico surveyor and must be based on the best available data;
- All existing and proposed final grading contours; and
- If a retaining wall or yard wall is proposed, the top and bottom of wall elevations must be included along with the soil elevation on each side of the wall.

☐ **Certified Topographic and Slope Analysis** if slopes greater than 10% are disturbed, provide the following:

- Topography based on every two feet of elevation change. The slope analysis should include three different slope ranges (0-19.99%, 20-29.99% and 30% and

greater). This must be stamped and sealed by a licensed New Mexico surveyor and must be based on the best available data.
- Slopes greater than 30% can be shown based on every 5' of elevation change.

☐ **Short Term and Long Term Erosion Control Plan**
- Show compliance with SFCC Section 14-8.2(D)(1)(d).
- If a Stormwater Pollution Prevention Plan is required by the EPA NPDES Program, the map of temporary and long term Best Management Practices can be submitted to meet the City requirement.

_____ **9. Architectural Plans: (Minimum scale ¼"=1') must include:**
Sealed by an architect registered in the State of New Mexico

☐ **Building Elevations (Minimum scale ¼")**
- Building height at the center line of each façade from finish grade to the highest point of the structure.
- Exterior building features, size, location, materials, colors, windows, doors, glazing systems, wall mounted equipment and lighting. Indicate surface area of materials, colors, doors and windows. Complete "Architectural Design Points Sheet" (Form O) from Architectural and Site Design ordinance. *(Article 14-8.7 SFCC)*
- Building length and width
- Finish grade
- Natural grade at building perimeter
- Wall and Fence typical

☐ **Floor Plans, Roof Plans and Reflected Ceiling Plans:**
- Show complete floor layout including equipment
- Identify the use of each room
- Identify the complete exiting system, including the occupant load of each room
- Provide a wall schedule to identify new bearing/non-bearing walls, and different height walls
- Provide dimension of rooms, corridors, door, etc.
- State the occupancy classification of the adjoining suites
- Provide energy code requirement for the building envelope and related details
- Identify fire rated assemblies (if applicable) and provide architectural details
- Show accessibility information to include:
  - the location and dimensions of the accessible restroom facilities
  - the location and dimensions of elevators (if applicable)
- Provide building cross-sectional views
- Provide general architectural details
- Provide wall details (top and bottom connection details with approved listed anchors)
- Provide floor/wall finish schedule

_____ **10. Structural Drawings:**

Sealed by either a structural or civil engineer registered in the State of New Mexico

- General Structural Notes
  - Design Dead Loads
  - Design Live Loads
  - Wind Design Data
  - Seismic Design Data
  - Specific Loads (if applicable) that are specific by the code
  - Identify all Special Inspection and Structural Observation requirements
  - Material Specifications
  - Geotechnical Information, i.e. Soils Class, Allowable Bearing Pressure, other information pertaining to the design
- Foundation Plan
  - Indicate shear wall and hold down locations
  - Footing bearing or top of footing elevations
  - Anchor size and placement
- Floor Framing Plan
  - Indicate shear wall hold down locations
  - Framing floor layout and sizes
  - Section and detail cuts
- Roof Framing Plan
  - Framing roof layout and sizes
  - Section and detail cuts
- Wall Framing Information and Details
- Structural Details
  - General structural details, connection details and all cut structural details called out from structural foundation/framing plans
- Calculations to validate design input loads, output data, connection details, etc.
- Special Reports for Alternative Building Materials

Prefabricated Metal Building:

- Provide separate manufacturer's construction drawing and calculations that are sealed by the structural engineer of record for the prefabricated metal building

_____ **11. Plumbing Plan must include:**

Sealed by a mechanical engineer registered in the State of New Mexico

- Complete on-site water and sewer plans
- Complete plumbing floor plan and roof drainage systems for the entire project area with risers in isometric view
- Minimum plumbing fixture analysis
- Plumbing fixture specifications and connection schedule
- Drain, waste and vent sizing isometrics
- Backflow Devices – Types and Location
- Gas pipe sizing calculations and isometric (if applicable)
  - Identify Gas meter location

- Provide one-line gas pipe, sizing diagram
- All appliance locations and Btu/hr input ratings
- All branch pipe lengths and sizes
- Identify all gas pipe materials and locations, i.e., underground, building wall, roof, etc.
- Specify gas pipe support method and spacing
- Address gas venting and combustion air

_____ **12. Mechanical Plan must include**:

- Complete mechanical floor plan
- Mechanical layout (ductwork, A/C units, air-handlers, diffusers, etc.)
- Mechanical equipment listings, specifications and weight
- Outside air ventilation calculations
- Air-balance schedule
- HVAC equipment specifications
- HVAC duct detector automatic shutoffs
- HVAC duct detector audible /visual alarms and trouble lights
- Restroom exhaust ventilation systems
- Identify any special inspection items

_____ **13. Electrical Plan must include:**

Sealed by an electrical engineer registered in the State of New Mexico

- Panel board location
- Lighting & power plan
- Equipment schedules
- Panel schedules
- Load calculations
- Wiring methods, specifications

IMPORTANT INFORMATION ABOUT SUBMITTAL

Four (4) complete sets of plans meeting the minimum criteria of the Building Permit Submittal Checklist are to be submitted in person to the Building Permit Division, 200 Lincoln Avenue, Santa Fe, NM 87504, First Floor, West Wing.

Fees: Plan check and building permit fees are based on Resolution No 2008.83 which is available upon request or at http://www.santafenm.gov/index.asp?nid=167 A plan check fee will be collected at application, the remainder plus any impact fees will be collected at permit issuance.

Revisions: Plans will be reviewed for compliance and either approved or rejected. Rejected plans must be corrected for compliance and resubmitted after the initial review cycle has been completed. The applicant will receive a phone call from the Building Permit Expeditor when revisions can be accepted.

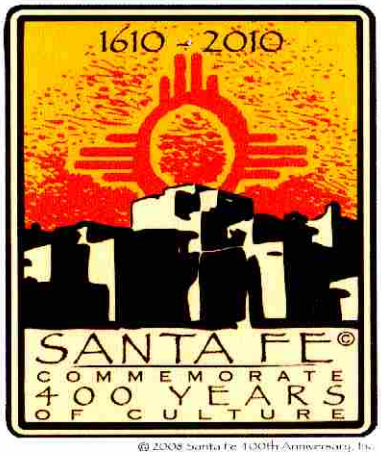
Application Tracking: Monitor the status of the application using the City's Voice Inspections/Permit System **(VIPS).** (505) 955-6110, Option 4. The pass code is the application tracking #.

General Contractor Licensing: General contractor must obtain valid Santa Fe City Business License and a valid New Mexico State Contractor's License before a permit will be issued.

Permit Notification and Inspections: Once a building permit is issued, it is the responsibility of the permittee to immediately post the Building Permit Poster in a conspicuous place visible from the public way, to place the approved perforated plans and supporting documents at the site for inspectors and to schedule required inspections.

Permit Expiration/Extensions: A building permit is valid for one year from date of issuance provided construction has commenced within 180 days, otherwise, the permit becomes invalid. An extension may be granted by the Building Permit Division if requested in writing by the applicant before the permit expires.

Appeals: Appeals may be filed by any person aggrieved by any decision made by officials administering Article 14-3.17, SFCC 1987. Such appeals must be filed within thirty (30) days of issuance of the building permit.



City of Santa Fe

Walls & Fences
Building Permit Application Checklist

Completed Applications are accepted Monday through Friday 8:00 a.m. to 12:00 p.m. and 1:00 p.m. through 5:00 p.m. by the Building Permit Division located at 200 Lincoln Avenue, Santa Fe, New Mexico, 87504. Questions may be directed in person or by phone. (505) 955 6588. Checklist available at www.santafenm.gov

Applications will be accepted only after full completion of the items herein once verified by the City Building Permit Specialist. Contents herein are minimum compliance requirements for applicable federal, state and local ordinances and standards including the 2006 New Mexico Commercial Code. For specifics, contact a Building Plan Reviewer at (505) 955-6588.

PRE-REQUISITE-APPROVALS: The following pre-requisite approvals must accompany the building permit application: (if applicable)

- ☐ Address Issuance or Verification
- ☐ Final Board or Committee Action Including Filing of Appropriate Documents, Plats and Development Plans
- ☐ Floodplain Verification – Technical Review Division
- ☐ Historic Preservation District Approval-Form D
- ☐ Escarpment Overlay District Approval-Form E
- ☐ Archeological Clearance Permit – Historic Preservation Division

MINIMUM SUBMITTALS/BUILDING PERMIT APPLICATION

Three (3) complete sets of proposed construction plans, pre-requisite compliance documents, and information described below:

_____**1. Building Permit Application:** Complete all required fields and answer all questions. Blue or Black ink only.

_____**2. Legal Lot of Record:** City approved subdivision plat. In the absence of an approved plat, provide a warranty deed and/or survey dated pre 1962 describing the meets and bounds of the property.

_____**3. Property Location/Vicinity Map**: Depict nearest street intersections and north arrow. May be placed on the site plan.

_____**4. Development Plan (if applicable)**: City approved with signatures and Santa Fe County recording data.

_____**5. Site Plan:** (Minimum scale 1"=20')

a. North arrow
b. Official property address
c. Zone district
d. Street names
e. Lot Dimensions, meets and bounds
f. Lot area and acreage
g. Existing and proposed improvements
h. Parking layout. *(Reference Article 14-8.6 SFCC)*
i. Easements including any and all encumbrances; access, public utility, private, etc.
j. Existing and proposed impervious areas
k. Existing and proposed wall and fences
l. Flood zones and other drainage discharges

_____**6. Terrain Management Requirements** *(Article 14-8.2(B) SFCC for applicability)*

☐ **Minor Development Project.** All of the following four criteria must exist for a project to be considered "Minor Development". *(Article 14-8.2, SFCC 1987).*

1. No more than 3,500 square feet of new impervious surface proposed;
2. No more than 5,000 square feet of total disturbance on the legal lot;
3. No more than 10% slopes disturbed, and
4. Drainage pattern is maintained (any new impervious surface means that the drainage pattern is NOT maintained).

Grading and Drainage Plan (Minimum scale 1"=20') must include:

- Location of all impervious surfaces with square footage identified;
- Calculation of storm water requirement. New impervious surface square footage multiplied by 16% (.16) equals the cubic feet of storage required;
- Stormwater storage capacity based on the calculation above. Detention pond, retention pond, infiltration device, active water harvesting or passive water harvesting are all acceptable;
- Sufficient topographic information to show that there are no slopes greater than 10% disturbed. Include sea level datum at two foot contour intervals. This can be obtained from the City's interactive website;
- If a retaining wall or yard wall is proposed, the top and bottom of wall elevations must be included along with the soil elevation on each side of the wall;
- One percent (1%) chance event floodplain (100 year floodplain) if located on the legal lot. This must be stamped and sealed by a licensed New Mexico surveyor and must be based on the best available data.

- All proposed grading, new final contours, slope limits, spot elevations including all surfaces as per *(Article 14-8.2, SFCC 1987);*
- All easements.
- Erosion protection of all disturbed areas indicating methods to be used *(Article 14-8.2, SFCC 1987).*

_____ 7. Structural Plans (Minimum ¼"=1') must include:

- Wall and fence elevation. Label height
- Wall section/typical

_____ 8. Electrical Plan must include:

- Lighting & power plan
- Wiring methods, specifications

IMPORTANT INFORMATION ABOUT SUBMITTAL:

Submittal: Three (3) complete sets of plans meeting the minimum criteria of the Building Permit Submittal Checklist are to be submitted in person to the Building Permit Division, 200 Lincoln Avenue, Santa Fe, NM 87504, First Floor, West Wing.

Fees: Plan check and building permit fees are based on Resolution No 2008.83 which is available upon request or at http://www.santafenm.gov/index.asp?nid=167 A plan check fee will be collected at application, the remainder plus any impact fees will be collected at permit issuance.

Application Tracking: Monitor the status of the application using the City's Voice Inspections/Permit System **(VIPS).** (505) 955-6110, Option 4. The pass code is the application tracking #.

Revisions: Plans will be reviewed for compliance and either approved or rejected. Rejected plans must be corrected for compliance and resubmitted after the initial review cycle has been completed. The applicant will receive a phone call from the Building Permit Expeditor when revisions can be accepted.

General Contractor Licensing: General contractor must obtain valid Santa Fe City Business License and a valid New Mexico State Contractor's License before a permit will be issued.

Permit Notification and Inspections: Once a building permit is issued, it is the responsibility of the permittee to immediately post the Building Permit Poster in a conspicuous place visible from the public way, to place the approved perforated plans and supporting documents at the site for inspectors and to schedule required inspections.

Permit Expiration/Extensions: A building permit is valid for one year from date of issuance provided construction has commenced within 180 days, otherwise, the permit becomes invalid. An extension may be granted by the Building Permit Division if requested in writing by the applicant before the permit expires.

Appeals: Appeals may be filed by any person aggrieved by any decision made by officials administering Article 14-3.17, SFCC 1987. Such appeals must be filed within thirty (30) days of issuance of the building permit.

City of Santa Fe, New Mexico

P.O. Box 909, 200 Lincoln Ave., 87504-0909

ARCHAEOLOGICAL REVIEW COMMITTEE APPLICATION FOR PROJECT REVIEW

Application Type:

Reconnaissance Report _____ Preliminary Treatment Report _____

Treatment Plan _____ Final Treatment Report _____

Project Location:

District:
Historic Downtown ____ River & Trails ____ Suburban ____

Project Surface Disturbance (Sq. Ft.): _____ Development Acreage: _____

Utility Main: _____ Extension length: _____

Archaeological Consultant: Address: Phone:

Applicant: Address: Phone:

Owner (if different): Address: Phone:

I certify that the documents submitted herein to the Archaeological Review Committee meet the minimum standards set forth in the Archaeological Ordinance, Section 14-75 SFCC 1987, and applicable policies. Failure to meet these standards and policies, or incomplete submissions, may result in delays in processing of this application.

Signature of Archaeological Consultant or Applicant Date

FOR OFFICIAL USE ONLY

Date Received: Case Number: Meeting Date:

Date of Project Activity Form Transmittal (with Project Report) to ARMS:

PLU016.PM5-Rev3/95

Appendix E3

Right of Way and Excavation Permit

Revised 5/24/06

CITY OF SANTA FE
STREETS & DRAINAGE
MAINTENANCE DIVISION

PERMIT #

1-800-321-2537

NM ONECALL (BLUESTAKE)

RIGHT-OF-WAY EXCAVATION & RESTORATION PERMIT

The undersigned hereby makes application to the City of Santa Fe Streets & Drainage Maintenance Division (SDMD) to perform work, as described below, within a public place and agrees to abide by all City ordinances, regulations and instructions pertaining to advance notification, traffic control, safety, excavation backfill and surface restoration. The undersigned understands that he is responsible for furnishing traffic control in accordance with the Manual Uniform Traffic Control Devices. Failure to comply with the Manual Uniform Traffic Devices will void this permit. The applicant is duly licensed by the City of Santa Fe to do the work herein contemplated and agrees to render the city of Santa Fe harmless from any loss or liability by reason of injury to persons or property occasioned or caused by the work herein contemplated.

] Print all information legibly. Illegible or incomplete permit applications will not be processed. [

1. APPLICATION DATE: _____ 2. APPLICATION TYPE: ☐ ROUTINE ☐ EMERGENCY

3. APPLICANT/PRIMARY CONTRACTOR: _____ LICENSE NUMBER: _____

Bonding Company: _____ Insurance Company: _____ Exp. Date: _____

4. MAILING ADDRESS: _____ PH. OR CELL #: _____

Asphalt contractor: _____ License Number: _____

Concrete contractor: _____ License Number: _____

Material Testing Lab: _____ Subcontractors (Others) _____

5. ACTUAL LOCATION OF WORK /STREET ADDRESS IF DIFFERENT: _____

STREET SURFACE TYPE TO BE CUT OR REMOVED: ☐ ASPHALT ☐ CONCRETE ☐ DIRT ☐ GRAVEL ☐ SIDEWALK

PAVEMENT PENALTY APPLICABLE? ☐ YES ☐ NO

6. DESCRIBE IN DETAIL WORK TO BE COMPLETED: _____

7. ESTIMATED DIMENSIONS: _____ (Length) _____ (width) _____ (area)

ACTUAL DIMENSIONS: _____ (Length) _____ (width) _____ (area)

8. ESTIMATED WORK SCHEDULE: (TO INCLUDE SURFACE RESTORATION) _____ (Begin) _____ (End)

ACTUAL START DATE: _____

FULL ROAD CLOSURE REQUIRED?:

9. APPLICANT: _____ (PRINT NAME) _____ (SIGNATURE)

PERMIT ISSUE/APPROVAL DATE: **PERMIT APPROVED BY:**

FEE CALCULATION

a. Permit 11001.421200 _____

b. New Pavement Penalty 11001.431150 _____

c. Other _____

d. Other _____

TOTAL $ _____

shaded areas for office personnel only

* Excavation limited to 200' unless otherwise approved by the SDFMD Inspector
* Primary contractor is responsible for quality of work and warranty work if needed
* Please indicate below where street cut is to be made. Show measurements including those from corner of manhole where necessary. Note all appropriate information such as name of street(s), size and approximate location of excavation, location of sidewalk or drainag

PERMIT NOT VALID WITHOUT A RECEIPT FOR NON-FRANCHISE UTILITY CONTRACTORS.

October 19, 2009

City of Santa Fe
Streets & Drainage Management Division
Attention: Merlyne Ortiz
P.O. Box 909
Santa Fe, NM 87504-0909

Re: Right-of-Way Permit

Dear Ms. Ortiz:

Please find enclosed the City of Santa Fe Right-of-Way Excavation & Restoration Permit Application and a check for the appropriate fee. Please call me at (505) 353-9133 if you have any questions concerning the application.

Please note that work at the site is scheduled to begin Monday, October 26. Please let me know if there is anything we need to do to expedite the right-of-way permit.

Thank you for all your help.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.

Jeanie Stroud

Jeanie Stroud
Senior Administrative Assistant

Enclosure

Daniel B. Stephens & Associates, Inc.

6020 Academy NE, Suite 100 505-822-9400

Albuquerque, NM 87109 FAX 505-822-8877

Revised 5/24/06

CITY OF SANTA FE
STREETS & DRAINAGE
MAINTENANCE DIVISION

PERMIT #

1-800-321-2537

NM ONECALL (BLUESTAKE)

RIGHT-OF-WAY EXCAVATION & RESTORATION PERMIT

The undersigned hereby makes application to the City of Santa Fe Streets & Drainage Maintenance Division (SDMD) to perform work, as described below, within a public place and agrees to abide by all City ordinances, regulations and instructions pertaining to advance notification, traffic control, safety, excavation backfill and surface restoration. The undersigned understands that he is responsible for furnishing traffic control in accordance with the Manual Uniform Traffic Control Devices. Failure to comply with the Manual Uniform Traffic Devices will void this permit. The applicant is duly licensed by the City of Santa Fe to do the work herein contemplated and agrees to render the city of Santa Fe harmless from any loss or liability by reason of injury to persons or property occasioned or caused by the work herein contemplated.

] Print all information legibly. Illegible or incomplete permit applications will not be processed. [

1. APPLICATION DATE: 10/19/09

2. APPLICATION TYPE: ☒ ROUTINE ☐ EMERGENCY NM-02-043602-00-5

3. APPLICANT/PRIMARY CONTRACTOR: Daniel B. Stephens & Assoc. LICENSE NUMBER: Santa Fe - 09-00002069

Bonding Company: Mid Continent Casualty Insurance Company: Greenwich Insurance Exp. Date: 4/3/10

4. MAILING ADDRESS: 6020 Academy NE, Suite 100, Albuquerque, NM 87109 PH. OR CELL #: 505-822-9400

Asphalt contractor: _____ License Number: _____

Concrete contractor: _____ License Number: _____

Material Testing Lab: _____ Subcontractors (Others) Enviro-Drill-WD-1186

5. ACTUAL LOCATION OF WORK /STREET ADDRESS IF DIFFERENT: See attached site figure + spreadsh

STREET SURFACE TYPE TO BE CUT OR REMOVED: ☒ ASPHALT ☐ CONCRETE ☐ DIRT ☐ GRAVEL ☒ SIDEWALK

PAVEMENT PENALTY APPLICABLE? ☐ YES ☐ NO

6. DESCRIBE IN DETAIL WORK TO BE COMPLETED: Installation of 2 soil vapor extraction (SVE) wells and 3 groundwater monitoring wells

7. ESTIMATED DIMENSIONS: See attached spreadsheet (Length) (width) (area)

ACTUAL DIMENSIONS: _____ (Length) (width) (area)

8. ESTIMATED WORK SCHEDULE: (TO INCLUDE SURFACE RESTORATION) 10/26/09 (Begin) 11/1/09 (End)

ACTUAL START DATE: _____

FULL ROAD CLOSURE REQUIRED?: _____

9. APPLICANT: Michael D. McVey (PRINT NAME) _____ (SIGNATURE)

PERMIT ISSUE/APPROVAL DATE: _____ PERMIT APPROVED BY: _____

FEE CALCULATION

a. Permit 11001.421200 _____

b. New Pavement Penalty 11001.431150 _____

c. Other _____

d. Other _____

TOTAL $ _____

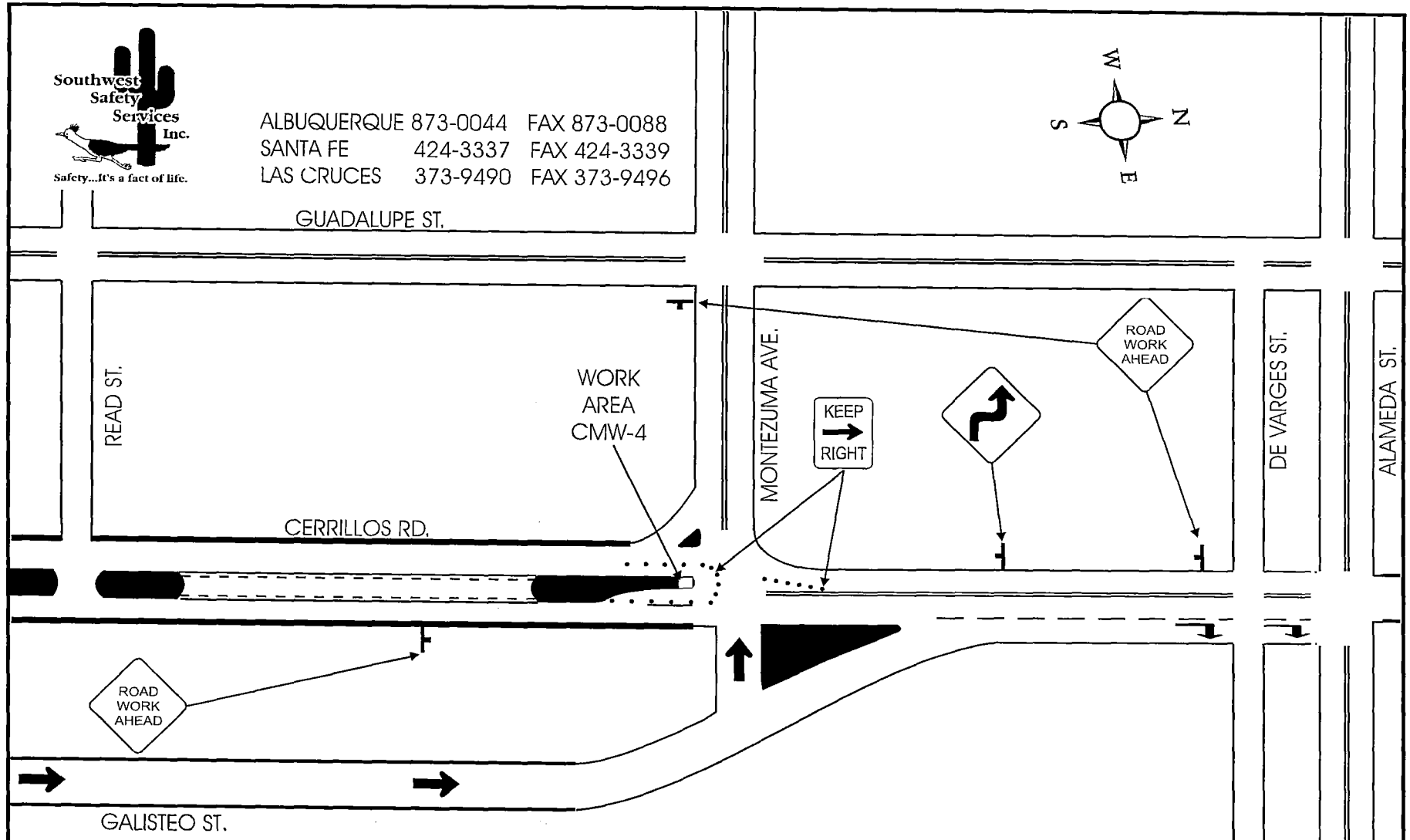
shaded areas for office personnel only

* Excavation limited to 200' unless otherwise approved by the SDFMD Inspector
* Primary contractor is responsible for quality of work and warranty work if needed
* Please indicate below where street cut is to be made. Show measurements including those from corner of manhole where necessary. Note all appropriate information such as name of street(s), size and approximate location of excavation, location of sidewalk or drainag

PERMIT NOT VALID WITHOUT A RECEIPT FOR NON-FRANCHISE UTILITY CONTRACTORS.

Southwest Safety Services Inc.
Safety...It's a fact of life.

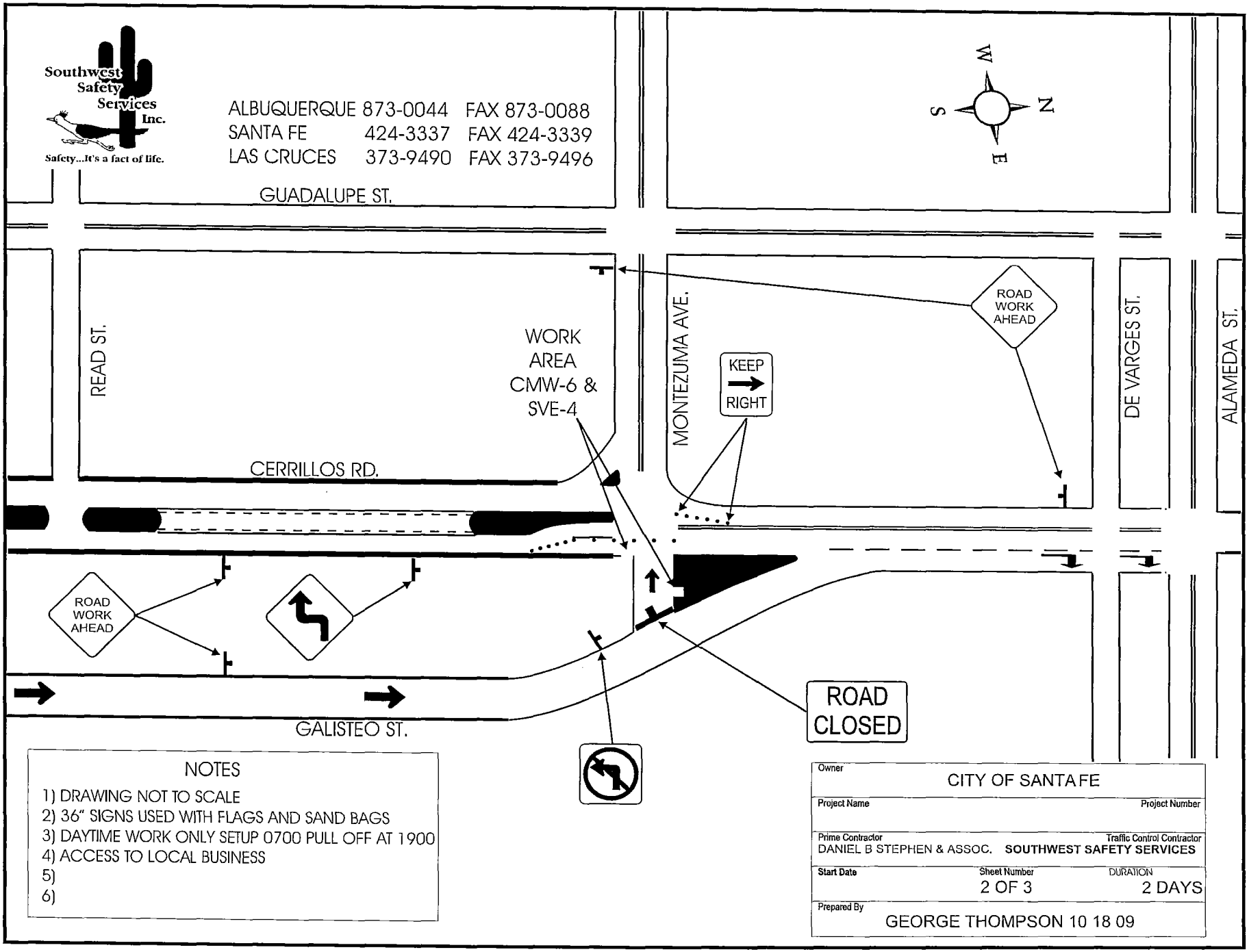
ALBUQUERQUE 873-0044 FAX 873-0088
SANTA FE 424-3337 FAX 424-3339
LAS CRUCES 373-9490 FAX 373-9496



NOTES

1) DRAWING NOT TO SCALE
2) 36" SIGNS USED WITH FLAGS AND SAND BAGS
3) DAYTIME WORK ONLY SETUP 0700 PULL OFF AT 1900
4) ACCESS TO LOCAL BUSINESS
5)
6)

Owner	CITY OF SANTA FE	
Project Name		Project Number
Prime Contractor		Traffic Control Contractor
DANIEL B STEPHEN & ASSOC.		SOUTHWEST SAFETY SERVICES
Start Date	Sheet Number	DURATION
	1 OF 3	2 DAYS
Prepared By	GEORGE THOMPSON 10 18 09	


Southwest Safety Services Inc.
Safety...It's a fact of life.
ALBUQUERQUE 873-0044 FAX 873-0088
SANTA FE 424-3337 FAX 424-3339
LAS CRUCES 373-9490 FAX 373-9496
W
S
N
E
GUADALUPE ST.
READ ST.
WORK AREA CMW-6 & SVE-4
CERRILLOS RD.
MONTEZUMA AVE.
ROAD WORK AHEAD
KEEP RIGHT
DE VARGES ST.
ALAMEDA ST.
ROAD WORK AHEAD
GALISTEO ST.
ROAD CLOSED
NOTES
1) DRAWING NOT TO SCALE
2) 36" SIGNS USED WITH FLAGS AND SAND BAGS
3) DAYTIME WORK ONLY SETUP 0700 PULL OFF AT 1900
4) ACCESS TO LOCAL BUSINESS
5)
6)
Owner
CITY OF SANTA FE
Project Name
Project Number
Prime Contractor
DANIEL B STEPHEN & ASSOC.
Traffic Control Contractor
SOUTHWEST SAFETY SERVICES
Start Date
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2 OF 3
DURATION
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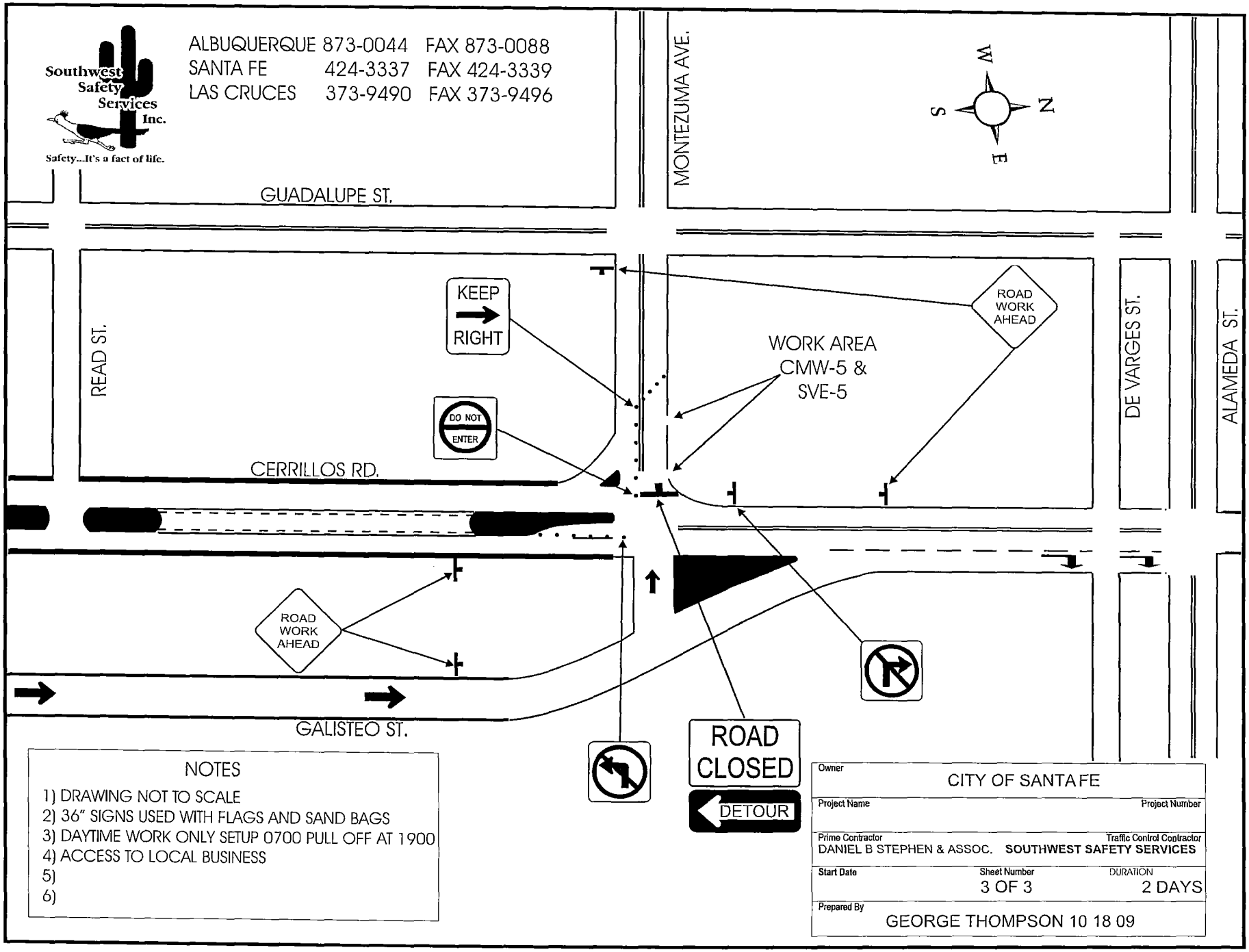

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6)

Owner	CITY OF SANTA FE	
Project Name		Project Number
Prime Contractor		Traffic Control Contractor
DANIEL B STEPHEN & ASSOC.		SOUTHWEST SAFETY SERVICES
Start Date	Sheet Number	DURATION
	3 OF 3	2 DAYS
Prepared By	GEORGE THOMPSON 10 18 09	

S:/PROJECTS/ES09.0215_MONTEZUMA_REMEDIATION/GIS/MXDS/PROPOSED_LOCS/PROP_WELLS_GALISTEO.MXD 909001

Explanation

- Proposed SVE well
- Proposed monitor well

Sources: 1. RGIS aerial photograph dated April 26, 2005 acquired via Google Earth

Figure 1

Daniel B. Stephens & Associates, Inc.
10/09/2009
JN ES09.0215

STATE LEAD REMEDIATION
SERVICES RFP #10-667-00-0001

Proposed Well Locations

Right-of-Way Excavation Sites					
Well	Location	Estimated Dimensions			Surface Type
		Length	Width	Area	
SVE-4	West side of juncture of Cerrillos Rd. and Galisteo St.; east of Montezuma Avenue	3 ft.	3 ft.	9 sq. ft.	Sidewalk
SVE-5	Southwest side of Journal North building (328 Galisteo)	3 ft.	3 ft.	9 sq. ft.	Sidewalk
CMW-4	North end of island separting Cerrillos Rd at juncture of Montezuma Ave.	3 ft.	3 ft.	9 sq. ft.	Asphalt
CMW-5	Corner of Montezuma Ave. and Cerrillos Rd.-South of Journal North building (328 Galisteo)	3 ft.	3 ft.	9 sq. ft.	Sidewalk
CMW-6	Southeast corner of island at juncture of Montezuma Ave., Cerrillos Rd. and Galisteo St.	3 ft.	3 ft.	9 sq. ft.	Sidewalk

Client#: 24241 DANIEBST1

ACORD™ CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YYYY) 05/21/09

PRODUCER
USI Southwest Inc. NM /CL
4700 Montgomery NE Ste. 300
Albuquerque, NM 87109
505 256-6308

THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.

INSURED
Daniel B. Stephens & Associates, Inc.
6020 Academy NE, #100
Albuquerque, NM 87109

INSURERS AFFORDING COVERAGE	NAIC #
INSURER A: Greenwich Insurance Company	22322
INSURER B: Fireman's Fund Ins Co of LA	40681
INSURER C: XL Specialty Insurance Company	37885
INSURER D:	
INSURER E:	

COVERAGES

THE POLICIES OF INSURANCE LISTED BELOW HAVE BEEN ISSUED TO THE INSURED NAMED ABOVE FOR THE POLICY PERIOD INDICATED. NOTWITHSTANDING ANY REQUIREMENT, TERM OR CONDITION OF ANY CONTRACT OR OTHER DOCUMENT WITH RESPECT TO WHICH THIS CERTIFICATE MAY BE ISSUED OR MAY PERTAIN, THE INSURANCE AFFORDED BY THE POLICIES DESCRIBED HEREIN IS SUBJECT TO ALL THE TERMS, EXCLUSIONS AND CONDITIONS OF SUCH POLICIES. AGGREGATE LIMITS SHOWN MAY HAVE BEEN REDUCED BY PAID CLAIMS.

INSR LTR	ADD'L INSRD	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	POLICY EXPIRATION DATE (MM/DD/YY)	LIMITS	
A		GENERAL LIABILITY X COMMERCIAL GENERAL LIABILITY CLAIMS MADE X OCCUR GEN'L AGGREGATE LIMIT APPLIES PER: POLICY PRO-JECT LOC	GEC000207608	04/03/09	04/03/10	EACH OCCURRENCE DAMAGE TO RENTED PREMISES (Ea occurrence) MED EXP (Any one person) PERSONAL & ADV INJURY GENERAL AGGREGATE PRODUCTS - COMP/OP AGG	$1,000,000 $100,000 $5,000 $1,000,000 $2,000,000 $2,000,000
C		AUTOMOBILE LIABILITY X ANY AUTO ALL OWNED AUTOS SCHEDULED AUTOS X HIRED AUTOS X NON-OWNED AUTOS	AEC000207709	04/03/09	04/03/10	COMBINED SINGLE LIMIT (Ea accident) BODILY INJURY (Per person) BODILY INJURY (Per accident) PROPERTY DAMAGE (Per accident)	$1,000,000 $ $ $
		GARAGE LIABILITY ANY AUTO				AUTO ONLY - EA ACCIDENT OTHER THAN AUTO ONLY: EA ACC AGG	$ $ $
A		EXCESS/UMBRELLA LIABILITY X OCCUR CLAIMS MADE DEDUCTIBLE RETENTION $	UEC000207909	04/03/09	04/03/10	EACH OCCURRENCE AGGREGATE	$10,000,000 $10,000,000 $ $ $
B		WORKERS COMPENSATION AND EMPLOYERS' LIABILITY ANY PROPRIETOR/PARTNER/EXECUTIVE OFFICER/MEMBER EXCLUDED? If yes, describe under SPECIAL PROVISIONS below	WZC80972772	04/03/09	04/03/10	X WC STATU-TORY LIMITS OTH-ER E.L. EACH ACCIDENT E.L. DISEASE - EA EMPLOYEE E.L. DISEASE - POLICY LIMIT	 $1,000,000 $1,000,000 $1,000,000
A		OTHER Professional & Pollution Legal	PEC000207808	04/03/09	04/03/10	$3,000,000 Each Claim $3,000,000 Aggregate $100,000 Retention	

DESCRIPTION OF OPERATIONS / LOCATIONS / VEHICLES / EXCLUSIONS ADDED BY ENDORSEMENT / SPECIAL PROVISIONS

LIMITS OF LIABILITY SHOWN ARE THOSE IN EFFECT AT INCEPTION.
City of Santa Fe is named as an Additional Insured on the General Liability & Automobile Liability when required by written contract.

CERTIFICATE HOLDER

City of Santa Fe
P.O. Box 909
Santa Fe, NM 87504

CANCELLATION

SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING INSURER WILL ENDEAVOR TO MAIL 30 DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT, BUT FAILURE TO DO SO SHALL IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE INSURER, ITS AGENTS OR REPRESENTATIVES.

AUTHORIZED REPRESENTATIVE
Maddy Cha

IMPORTANT

If the certificate holder is an ADDITIONAL INSURED, the policy(ies) must be endorsed. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

If SUBROGATION IS WAIVED, subject to the terms and conditions of the policy, certain policies may require an endorsement. A statement on this certificate does not confer rights to the certificate holder in lieu of such endorsement(s).

DISCLAIMER

The Certificate of Insurance on the reverse side of this form does not constitute a contract between the issuing insurer(s), authorized representative or producer, and the certificate holder, nor does it affirmatively or negatively amend, extend or alter the coverage afforded by the policies listed thereon.

MID-CONTINENT CASUALTY COMPANY

LICENSE AND PERMIT BOND

Bond No. 1000761

KNOW ALL MEN BY THESE PRESENTS:

That we, Daniel B. Stephens and Associates, Inc. (NAME)

of 6020 Academy (ADDRESS) State of New Mexico, as Principal and the MID-CONTINENT CASUALTY COMPANY, a corporation duly licensed to do business in the State of NM, as Surety, are held and firmly bound unto City of Santa Fe (OBLIGEE), State of New Mexico, Obligee, in the penal sum of Ten Thousand and No/100's ($ 10,000.00) Dollars, lawful money of the United States, to be paid to the said Obligee, for which payment well and truly to be made, we bind ourselves and our legal representatives, jointly and severally by these presents.

THE CONDITION OF THE ABOVE OBLIGATION IS SUCH, That whereas, the said Principal has been licensed as General Contractor by the said Obligee.

NOW THEREFORE, if the said Principal shall faithfully perform the duties and in all things comply with the laws and ordinances, including all Amendments thereto, appertaining to the license or permit applied for, then this obligation to be void, otherwise to remain in full force and effect.

This bond may be terminated at any time by the Surety upon sending notice in writing, by certified mail, to the clerk of the Political Subdivision with whom this bond is filed and to the Principal, addressed to them at the Political Subdivision named herein and at the expiration of thirty (30) days from the mailing of said notice, this bond shall ipso facto terminate and the Surety shall thereupon be relieved from any liability for any acts or omissions of the Principal subsequent to said date.

Dated this 28th day of May, 2009

Daniel B. Stephens & Associates, Inc.
Principal

BY: Deborah A. Stephens

MID-CONTINENT CASUALTY COMPANY

BY: April M Terbay
Attorney-in-Fact

SEAL

P.O. BOX 1409 TULSA, OKLAHOMA 74101-1409 918-587-7221 1-800-722-4994 FAX: 918-588-1296

CC-L&P

MID-CONTINENT CASUALTY COMPANY
Tulsa, Oklahoma

Know all Men by these presents: That the MID-CONTINENT CASUALTY COMPANY, a corporation of the State of Oklahoma, having its principal office in the city of Tulsa, Oklahoma, pursuant to the following By-Law, which was adopted by the Stockholders of the said Company on March 13th, 1947, to-wit:

"Article IV, Section 7. -- The Executive Officers of the Company shall have power and authority to appoint, for purposes only of executing and attesting bonds and undertakings and other writings obligatory in the nature thereof, one more Resident Vice President, Resident Assistant Secretaries and Attorneys-in-Fact and at any time to remove any such Resident Vice President, Resident Assistant Secretary, or Attorney-in-Fact and revoke the power and authority given him. None of such appointees need be Directors of the Company."

The Company does hereby constitute and appoint Linda K. Edwards, Robert C. Fricke, Cynthia Giesen, Daryll W. Martin, William H. Pitts, Jr., Norman P. Rolling, James O. Schnell, Steven W. Searcey, Robert C. Siddons, April M. Terbay and Douglas J. Wealty, individually of AUSTIN,

its true and lawful attorney(s)-in-fact, to execute, seal and deliver for and on its behalf as Surety, and as its act and deed, Any and all bonds and undertakings of Suretyship

And the execution of such instrument(s) in pursuance of these presents, shall be as binding upon the said MID-CONTINENT CASUALTY COMPANY, as fully and amply, to all intents and purposes, as if the same had been duly executed and acknowledged by its regularly elected officers at its principal office in Tulsa, Oklahoma.

IN WITNESS WHEREOF, MID-CONTINENT CASUALTY COMPANY has executed and attested these presents this 24 day of February , 2009

ATTEST:

Sara Anderson
SARA ANDERSON ASSISTANT SECRETARY

Todd Bazata
TODD BAZATA VICE PRESIDENT

On this 24 day of February , 2009 before me, a Notary Public of the State of Oklahoma in and for the County of Tulsa, came the individual to me personally known to be the officer described in, and who executed the preceding instrument, and he acknowledged the execution of the same, and being by me duly sworn, said that he is the therein described and authorized officer of the MID-CONTINENT CASUALTY COMPANY aforesaid, and that the seal affixed to the preceding instrument is the corporate of said Company, and the said corporate seal and his signature as such officer were duly affixed to the said instrument by the authority and direction of the said Company, and that Article IV, Section 7, of the By-Laws of said Company, referred to in the preceding instrument, is now in force.

IN TESTIMONY WHEREOF, I have hereunto set my hand and affixed my official seal at the City of Tulsa, the day and year first above written.

JULIE CALLAHAN NOTARY PUBLIC IN AND FOR STATE OF OKLAHOMA TULSA COUNTY

STATE OF OKLAHOMA } ss

COUNTY OF TULSA

Commission # 99009381
My Commission expires 06-07-11

Julie Callahan
JULIE CALLAHAN Notary Public

I, SARA ANDERSON Assistant Secretary of MID-CONTINENT CASUALTY COMPANY do hereby certify that the foregoing extracts of the By-Laws and of a Resolution of the Board of Directors of this corporation, and of a Power of Attorney issued pursuant thereto, are true and correct, and that both the By-Laws, the Resolution and the Power of Attorney are still in full force and effect.

This certifies that any facsimile or mechanically-produced signature of any officer of the Company and Company seal, wherever appearing upon a power of attorney issued by the Company, shall be valid and binding upon the Company with the same force and effect as though manually affixed.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the facsimile seal of said corporation

MID-CONTINENT CASUALTY COMPANY CORPORATE SEAL OKLAHOMA

this 28th day of May , 2009

Sara Anderson
SARA ANDERSON Assistant Secretary

STATE OF TEXAS

CLAIM NOTICE ENDORSEMENT

To be attached to and form a part of Bond No. 1000761

In accordance with Section 2253.021(f) of the Texas Government Code and Section 53.202(6) of the Texas Property Code any notice of claim to the named surety under this bond(s) should be sent to:

MID-CONTINENT CASUALTY COMPANY
OKLAHOMA SURETY COMPANY
P. O. BOX 1409
TULSA, OK 74101

TELEPHONE NO. 918 587-7221

Revised 5/24/06

CITY OF SANTA FE
STREETS & DRAINAGE
MAINTENANCE DIVISION

PERMIT #

1-800-321-2537

NM ONECALL (BLUESTAKE)

RIGHT-OF-WAY EXCAVATION & RESTORATION PERMIT

The undersigned hereby makes application to the City of Santa Fe Streets & Drainage Maintenance Division (SDMD) to perform work, as described below, within a public place and agrees to abide by all City ordinances, regulations and instructions pertaining to advance notification, traffic control, safety, excavation backfill and surface restoration. The undersigned understands that he is responsible for furnishing traffic control in accordance with the Manual Uniform Traffic Control Devices. Failure to comply with the Manual Uniform Traffic Devices will void this permit. The applicant is duly licensed by the City of Santa Fe to do the work herein contemplated and agrees to render the city of Santa Fe harmless from any loss or liability by reason of injury to persons or property occasioned or caused by the work herein contemplated.

] Print all information legibly. Illegible or incomplete permit applications will not be processed. [

1. APPLICATION DATE: 12/8/09

2. APPLICATION TYPE: ☒ ROUTINE ☐ EMERGENCY

3. APPLICANT/PRIMARY CONTRACTOR: Daniel B. Stephens + Assoc LICENSE NUMBER: NM-02-043602-00-5 Santa Fe-09-00002069

Bonding Company: Mid-Continent Casualty Insurance Company: Greenwich Insurance Exp. Date: 4/3/10

4. MAILING ADDRESS: 6020 Academy NE, Suite 100 Albuquerque, NM 87109 PH. OR CELL #: 505-822-9400

Asphalt contractor: _____ License Number: _____

Concrete contractor: _____ License Number: _____

Material Testing Lab: _____ Subcontractors (Others) AcuVac

5. ACTUAL LOCATION OF WORK /STREET ADDRESS IF DIFFERENT: 210-218 Montezuma

STREET SURFACE TYPE TO BE CUT OR REMOVED: ☐ ASPHALT ☐ CONCRETE ☐ DIRT ☐ GRAVEL ☐ SIDEWALK

PAVEMENT PENALTY APPLICABLE? ☐ YES ☐ NO

6. DESCRIBE IN DETAIL WORK TO BE COMPLETED: Soil vapor extraction (SVE) well pilot test at SVE-1 (See site map). No street surface or sidewalk to be cut or removed

7. ESTIMATED DIMENSIONS: ____ (Length) ____ (width) ____ (area)

ACTUAL DIMENSIONS: ____ (Length) ____ (width) ____ (area)

8. ESTIMATED WORK SCHEDULE: (TO INCLUDE SURFACE RESTORATION) 12/17/09 (Begin) 12/18/09 (End)

ACTUAL START DATE: _____

FULL ROAD CLOSURE REQUIRED?: _____

9. APPLICANT: Michael McVey (PRINT NAME) _____ (SIGNATURE)

PERMIT ISSUE/APPROVAL DATE: _____ PERMIT APPROVED BY: _____

FEE CALCULATION

shaded areas for office personnel only

a. Permit 11001.421200 _____

b. New Pavement Penalty 11001.431150 _____

c. Other _____

d. Other _____

TOTAL $ _____

* Excavation limited to 200' unless otherwise approved by the SDFMD Inspector
* Primary contractor is responsible for quality of work and warranty work if needed
* Please indicate below where street cut is to be made. Show measurements including those from corner of manhole where necessary. Note all appropriate information such as name of street(s), size and approximate location of excavation, location of sidewalk or drainag

PERMIT NOT VALID WITHOUT A RECEIPT FOR NON-FRANCHISE UTILITY CONTRACTORS.

S:/PROJECTS/ES09.0215_MONTEZUMA_REMEDIATION/GIS/MXDS/REPORTS/SVE_PILOT_TEST/TRAFFIC_CONTROL_AREA.MXD 908021

Explanation

- Existing monitor well
- Existing SVE well

Source: Aerial photograph dated November 2, 2009 flown by TRM

Figure 1

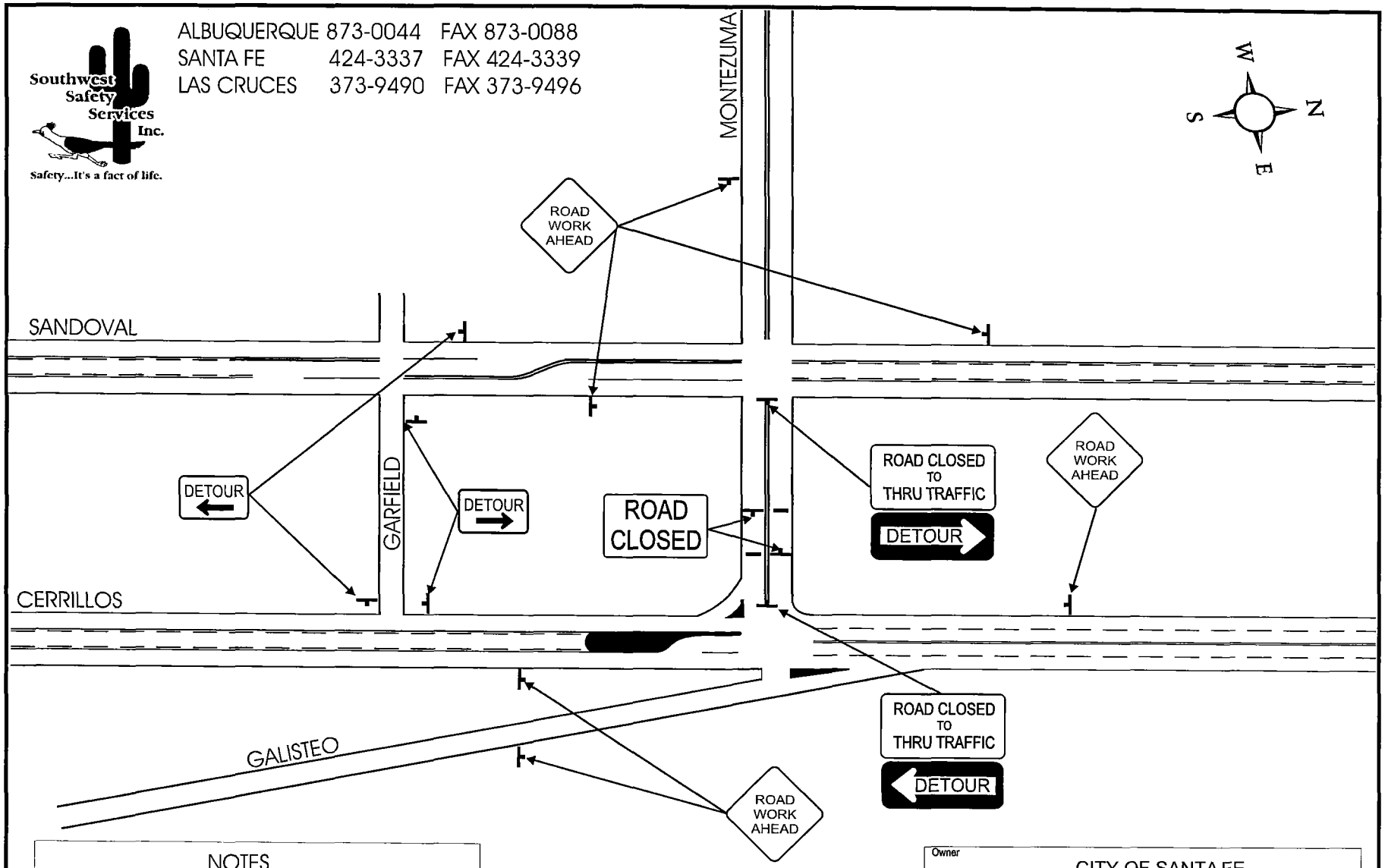
Daniel B. Stephens & Associates, Inc.
12/08/2009 JN ES09.0215

SANTA FE COUNTY JUDICIAL COMPELX

Traffic Control Area

Southwest Safety Services Inc.
Safety...It's a fact of life.

ALBUQUERQUE 873-0044 FAX 873-0088
SANTA FE 424-3337 FAX 424-3339
LAS CRUCES 373-9490 FAX 373-9496



NOTES
1) DRAWING NOT TO SCALE
2) 36" SIGNS USED WITH FLAGS AND SAND BAGS
3) ACCESS TO LOCAL BUSINESS
4) 24 HOUR SETUP
5) LIGHTS ON EQUIPMENT
6)

Owner	CITY OF SANTA FE
Project Name	Project Number
Prime Contractor: DANIEL B STEPHENS	Traffic Control Contractor: SOUTHWEST SAFETY SERVICES
Start Date	Sheet Number: 1 OF 1 — DURATION: 2 DAYS
Prepared By	GEORGE THOMPSON 12 08 09

120 S. Federal Suite 312 **City of Santa Fe** 955-6581 Fax: 955-6430

Parking Operations

Parking Meter Hood Application

DATE 12/8/09

BUSINESS NAME Daniel B. Stephens & Associates, Inc.

AUTHORIZED REPRESENTATIVE Michael D. McVey

STREET ADDRESS 6020 Academy NE, Suite 100

MAILING ADDRESS (if different) _____

PHONE 505-822-9400 FAX 505-822-8877 E-MAIL jstroud@dbstephens.com

REASON FOR REQUEST Right of way needed to perform soil vapor extraction pilot test for NM Environment Department

WORK ORDER INFORMATION

NUMBER OF SPACES NEEDED 4 # METERS 4 # DAYS 3 + $25 ADMIN FEE

PLEASE REMOVE _____ METER HEADS ($25 PER METER + $25 PER METER, PER DAY)

STREET LOCATION(S) 210 Montezuma Avenue

METER NUMBERS 1654, 1655, 1656, 1657

START DATE/TIME _____ END DATE/TIME _____

VEHICLE LICENSE(S) 1. _____ 2. _____ 3. _____ 4. _____

LIST SUBCONTRACTORS

APPROVED _____ DATE _____

OFFICE USE ONLY

4 PARKING METER HOODS X 3 DAYS X $30 = 360

ADMINISTRATIVE FEE (previously pd 9/29/09) + —

PAID __ CASH __ CHECK # _____

__ CREDIT CARD __ MasterCard __ VISA

TOTAL $360.00

RECEIPT # _____

120 S. Federal Suite 312 City of Santa Fe 955-6581 Fax: 955-6430

Parking Division

Parking Meter Hood and/or Stand-alone Yellow Zone* Policy and Procedures

1. The business, organization, or individual requesting the rental of one or more meter spaces, or use of a yellow zone, must justify, in writing, the need to park a vehicle in front of or near a particular work site or function. Construction, deliveries or loading or unloading equipment are appropriate uses for meter hoods. They are not to be used for personal, convenient parking spaces.

2. A detailed site plan and required space layout must be submitted to the Parking Division upon applying for the meter hood(s) or space in a yellow zone.

3. Each hood allows for rental of one metered space, 22 feet along the curb and not more than eight feet into the street within the parking lane, unless otherwise approved by the city.

4. Each yellow zone permit allows for the use of curb space, 22 feet along the curb and not more than eight feet into the street unless otherwise approved by the city.

5. Approval of the application will be based on the following:

   a. A vehicle with equipment or items that must be continuously loaded and unloaded at a particular site.

   b. A vehicle with equipment or items that cannot be hauled for a long distance.

   c. Using the sidewalk and/or street spaces. (Please keep the area clear to eliminate possible safety hazards due to construction.)

   d. Official or authorized city functions that make it necessary to park a vehicle (private or public) at a designated meter space.

6. The rental of a parking meter hood(s) or occupancy of a yellow zone is temporary and may only be used at the location specified on the application. All hood and permits are rented for a period of no more than thirty (30) calendar days. Should the applicant require additional time, the agreement must be renewed on or before the date the original application expires. Failure to do this will result in removal of the meter hoods by Parking Operations. Yellow-zone violators will be ticketed and/or towed.

7. Parking meter hoods are limited. Availability is first come, first served and will remain property of the city.

8. A one-time $25 per year administrative fee is charged to cover installation and removal costs or issuing a yellow-zone permit. Each meter hood or (yellow zone occupancy) is $30 per day including Sundays and holidays. (This charge is based upon reserved parking, current parking meter rates and the time the meter space(s) would ordinarily be occupied for any given day.)

9. Vehicles must display the meter hood permit (or yellow-zone permit) in the lower right-hand corner of the dashboard at all times while parked at meter or in a yellow zone. Vehicles not displaying the proper permit shall be subject to a $35 fine under Uniform Traffic Code Ordinance 12-6-6.1 and 12-6-6.12.

* **Permission to park in a yellow zone must be obtained from the Traffic Division 955-6619 and Utility Resource/ Land Management Division 955-6629 prior to applying for a yellow-zone permit with Parking Division.**

10. It is strongly recommended that applicants barricade space around hooded meters or yellow zones to ensure exclusive use. Barricades must comply with the *Manual on Uniform Traffic Control Devices.*

REMOVING PARKING METER HEADS

If it is determined that one or more parking meter heads need to be removed to prevent damage during construction, applicant may request it in writing.

1. A $30 fee per meter head removed and reinstalled will be charged in addition to the $30 per meter/per day fee.

2. Should it be necessary to remove a meter pole, it will be the applicant's responsibility to reinstall the meter pole, in accordance with required specifications.

3. All meter heads will be removed and reinstalled by Parking Division staff.

I have read and understand the City of Santa Fe Parking Division's "Parking Meter Hood and/or Stand-alone Yellow Zone Policy and Procedures." I agree to comply with the terms and conditions herein. I also agree to hold the city harmless for any and all losses, damages, claims or judgements on account of any suit, judgement, execution, claims, actions, or demands whatsoever resulting from the use of a meter space or meter hood or yellow-curb permit herein.

Authorized Representative

12/8/09
Date

Daniel B. Stephens + Assoc
Business Name

CITY OF SANTA FE

Transportation Operations Division

City of Santa Fe
Parking Operations

650

Meter Hood Permit

Organization	DANIEL B. STEPHENS & ASSOC.
Type of Vehicle	
Street	MONTEZUMA

METER # (S)	1654	1655	1656	1657		
Residential Area						

Date Issued 12/18/2009 Date Expired 12/19/2009

Authorized By IVAN BARRY

Appendix E4

Well Permit

John R. D Antonio, Jr., P.E.
State Engineer

Santa Fe Office
PO BOX 25102
SANTA FE, NM 87504-5102

STATE OF NEW MEXICO

Trn Nbr: 450019
File Nbr: RG 91565 POD 7

OFFICE OF THE STATE ENGINEER

Feb. 02, 2010

MICHAEL D. McVEY
NM ENVIRONMENT DEPARTMENT
6020 ACADEMY NE, SUITE 100
ALBUQUERQUE, NM 87109

Greetings:

Enclosed is your copy of the Exploratory Permit which has been approved. In accordance with the conditions of approval, the well can only be tested for 10 cumulative days. No water may be diverted or beneficially used from this well.

A complete well record shall be filed no later than twenty days after completion of the well.

Sincerely,

Kerri Sandoval

Kerri Sandoval
(505)827-6120

Enclosure

explore

File Number: RG-91565 POD7
(For OSE Use Only)

NEW MEXICO OFFICE OF THE STATE ENGINEER
APPLICATION FOR PERMIT
TO DRILL AN EXPLORATORY WELL

1. APPLICANT:

Name: New Mexico Environment Department Work Phone: (505) 822-9400
Contact: Daniel B. Stephens & Assoc., Inc c/o Michael D. McVey Home Phone: _____
Address: 6020 Academy NE, Suite 100
City: Albuquerque State: NM Zip: 87109

2. LOCATION OF WELL (A, B, C, or D required, E or F if known): SVE-6

A. ____1/4 ____1/4 ____1/4 Section:____ Township:____ Range:____ N.M.P.M.
in Santa Fe County.

B. X =_____ feet, Y = _____ feet, N.M. Coordinate System
_____ Zone in the _____ Grant.
U.S.G.S. Quad Map _____

C. Latitude: 35 d 41 m 4.2792 s Longitude: -105 d 56 m 34.2852 s

D. East _____ (m), North _____ (m), UTM Zone 13, NAD __ (27 or 83)

E. Tract No. _____, Map No. _____ of the _____ Hydrographic Survey

F. Lot No. _____, Block No. _____ of Unit/Tract _____ of the
_____ Subdivision recorded in _____ County.

G. Other: 328 Galisteo-Corner of Cerrillos Road and Montezuma Avenue, Santa Fe

H. Give State Engineer File Number of existing well: _____

I. On land owned by (required): Lowell Hare-Managing Partner 328 Galisteo

3. WELL INFORMATION:

Approximate depth 45 feet; Outside diameter of casing 2 inches.
Name of well driller and driller license number Enviro-Drill/WD1186

4. ADDITIONAL STATEMENT OR EXPLANATIONS:

Daniel B. Stephens & Associates has been contracted by New Mexico Environment Department to install Soil Vapor Extraction wells. Designated SVE-6

Do Not Write Below This Line

File Number: RG-91565 POD 7 Trn Number: 450019
Form: wr-07 page 1 of 2

File Number: RA-91565 POD 7
(For OSE Use Only)

NEW MEXICO OFFICE OF THE STATE ENGINEER
APPLICATION FOR PERMIT
TO DRILL AN EXPLORATORY WELL

ACKNOWLEDGEMENT

(I, We) Michael D. McVey affirm that the
(Please Print)
foregoing statements are true to the best of my knowledge and belief.

Applicant Signature _____ Applicant Signature

ACTION OF STATE ENGINEER

This application is approved ~~denied/partially approved~~ provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare, and further subject to the following conditions:

See attached Specific Conditions of Approval

Witness my hand and seal this 2nd day of February, 20 10

John R. D'Antonio Jr., P.E. State Engineer

By: Kerri Sandoval

Kerri Sandoval, Water Rights Division

Do Not Write Below This Line

File Number: RA-91565 POD 7 Trn Number: 450019

Form: wr-07 page 2 of 2

NEW MEXICO STATE ENGINEER OFFICE
PERMIT TO EXPLORE

SPECIFIC CONDITIONS OF APPROVAL

4 No water shall be appropriated and beneficially used under this permit.

B The well shall be drilled by a driller licensed in the State of New Mexico in accordance with Section 72-12-12 New Mexico Statutes Annotated.

C1 A complete and properly executed Well Record on the form provided by the State Engineer shall be filed not later than twenty (20) days after completion of the well.
Test data shall be filed not later than twenty (20) days after completion of the test(s).

G If artesian water is encountered, all rules and regulations pertaining to the drilling and casing of artesian wells shall be complied with.

LOG The Point of Diversion RG 91565 POD 7 must be completed and the Well Log filed on or before 02/02/2011.

ACTION OF STATE ENGINEER

Notice of Intention Rcvd: Date Rcvd. Corrected:
Formal Application Rcvd: 01/14/2010 Pub. of Notice Ordered:
Date Returned - Correction: Affidavit of Pub. Filed:

This application is approved provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare of the state; and further subject to the specific conditions listed previously.

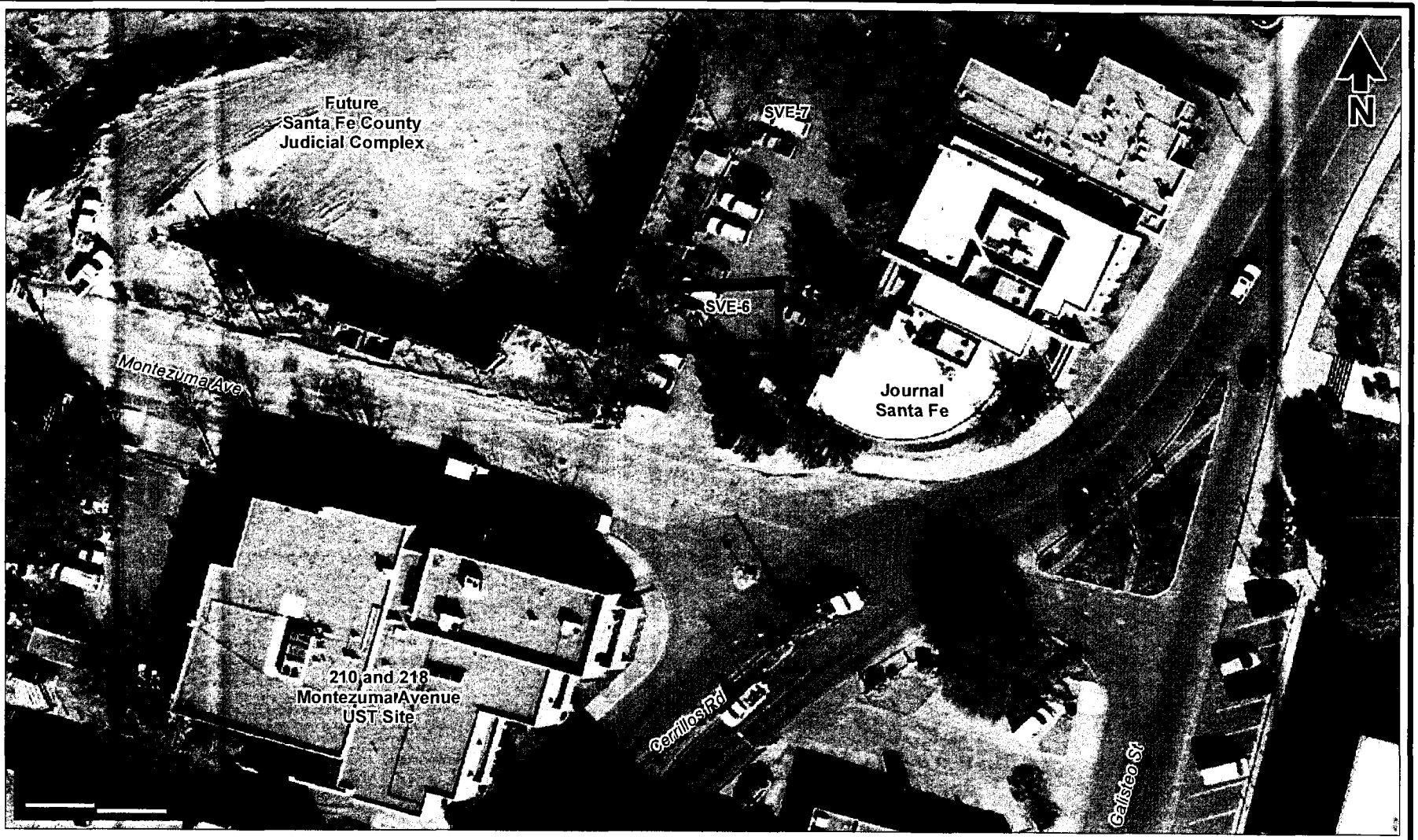
Witness my hand and seal this 02 day of Feb A.D., 2010

John R. D Antonio, Jr., P.E. , State Engineer

By: Kerri Sandoval
Kerri Sandoval

Trn Desc: RG 91565 POD7 File Number: RG 91565
Trn Number: 450019

S:/PROJECTS/ES09.0215_SFCJC/GIS/MXDS/REPORTS/SVE_PILOT_TEST/SITE_MAP_SOUTH.MXD 901221



Explanation

Proposed SVE well

Source: Aerial photograph dated November 2, 2009 flown by TRM

Figure 1

Daniel B. Stephens & Associates, Inc.
01/11/2010
JN ES09.0215

SANTA FE COUNTY JUDICIAL COMPELX

Proposed SVE Well Locations

John R. D Antonio, Jr., P.E.
State Engineer

Santa Fe Office
PO BOX 25102
SANTA FE, NM 87504-5102

STATE OF NEW MEXICO

Trn Nbr: 450026
File Nbr: RG 91565 POD 8

OFFICE OF THE STATE ENGINEER

Feb. 02, 2010

MICHAEL D. McVEY
NM ENVIRONMENT DEPARTMENT
6020 ACADEMY NE, SUITE 100
ALBUQUERQUE, NM 87109

Greetings:

Enclosed is your copy of the Exploratory Permit which has been approved. In accordance with the conditions of approval, the well can only be tested for 10 cumulative days. No water may be diverted or beneficially used from this well.

A complete well record shall be filed no later than twenty days after completion of the well.

Sincerely,

Kerri Sandoval
(505)827-6120

Enclosure

explore

File Number: RG-91565 POD 8
(For OSE Use Only)

NEW MEXICO OFFICE OF THE STATE ENGINEER
APPLICATION FOR PERMIT
TO DRILL AN EXPLORATORY WELL

1. APPLICANT:

Name: New Mexico Environment Department Work Phone: (505) 822-9400
Contact: Daniel B. Stephens & Assoc., Inc c/o Michael D. McVey Home Phone: _____
Address: 6020 Academy NE, Suite 100
City: Albuquerque State: NM Zip: 87109

2. LOCATION OF WELL (A, B, C, or D required, E or F if known): SVE-7

A. ____1/4 ____1/4 ____1/4 Section: ____ Township: ____ Range: ____ N.M.P.M.
in Santa Fe County.

B. X = _____ feet, Y = _____ feet, N.M. Coordinate System
_____ Zone in the _____ Grant.
U.S.G.S. Quad Map _____

C. Latitude: 35 d 41 m 4.9668 s Longitude: -105 d 56 m 34.0326 s

D. East _____ (m), North _____ (m), UTM Zone 13, NAD __ (27 or 83)

E. Tract No. _____, Map No. _____ of the _____ Hydrographic Survey

F. Lot No. _____, Block No. _____ of Unit/Tract _____ of the
_____ Subdivision recorded in _____ County.

G. Other: 328 Galisteo-Corner of Cerrillos Road and Montezuma Avenue, Santa Fe

H. Give State Engineer File Number of existing well: _____

I. On land owned by (required): Lowell Hare-Managing Partner 328 Galisteo

3. WELL INFORMATION:

Approximate depth 45 feet; Outside diameter of casing 2 inches.
Name of well driller and driller license number Enviro-Drill/WD1186

4. ADDITIONAL STATEMENT OR EXPLANATIONS:

Daniel B. Stephens & Associates has been contracted by New Mexico Environment Department to install Soil Vapor Extraction wells. Designated SVE-7

Do Not Write Below This Line

File Number: RG-91565 POD 8 Trn Number: 450026
Form: wr-07

File Number: RG-91565 POD 8
(For OSE Use Only)

NEW MEXICO OFFICE OF THE STATE ENGINEER
APPLICATION FOR PERMIT
TO DRILL AN EXPLORATORY WELL

ACKNOWLEDGEMENT

(I, We) Michael D. McVey affirm that the
(Please Print)
foregoing statements are true to the best of my knowledge and belief.

Applicant Signature _____ Applicant Signature

ACTION OF STATE ENGINEER

This application is (approved) ~~denied/partially approved~~ provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare, and further subject to the following conditions: _____

See attached Specific Conditions of Approval

Witness my hand and seal this 2nd day of February, 20 10

John R. D'Antonio Jr., P.E. State Engineer

By: Kerri Sandoval
Kerri Sandoval, Water Rights Division

Do Not Write Below This Line

File Number: RG-91565 POD 8 Trn Number: 450026

NEW MEXICO STATE ENGINEER OFFICE
PERMIT TO EXPLORE

SPECIFIC CONDITIONS OF APPROVAL

4 No water shall be appropriated and beneficially used under this permit.

B The well shall be drilled by a driller licensed in the State of New Mexico in accordance with Section 72-12-12 New Mexico Statutes Annotated.

C1 A complete and properly executed Well Record on the form provided by the State Engineer shall be filed not later than twenty (20) days after completion of the well.
Test data shall be filed not later than twenty (20) days after completion of the test(s).

G If artesian water is encountered, all rules and regulations pertaining to the drilling and casing of artesian wells shall be complied with.

LOG The Point of Diversion RG 91565 POD 8 must be completed and the Well Log filed on or before 02/02/2011.

ACTION OF STATE ENGINEER

Notice of Intention Rcvd:	Date Rcvd. Corrected:
Formal Application Rcvd: 01/14/2010	Pub. of Notice Ordered:
Date Returned - Correction:	Affidavit of Pub. Filed:

This application is approved provided it is not exercised to the detriment of any others having existing rights, and is not contrary to the conservation of water in New Mexico nor detrimental to the public welfare of the state; and further subject to the specific conditions listed previously.

Witness my hand and seal this 02 day of Feb A.D., 2010

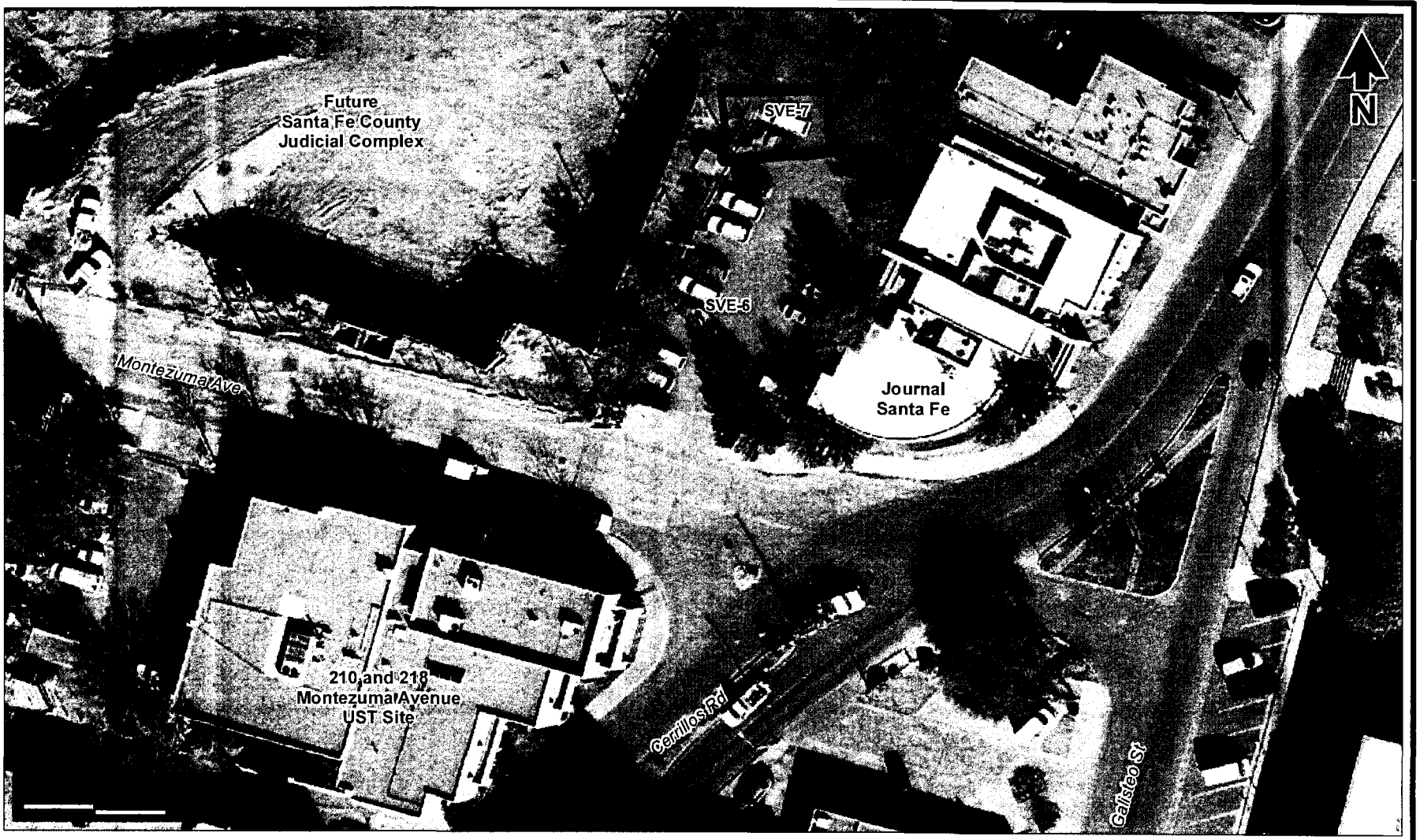
John R. D Antonio, Jr., P.E. , State Engineer

By: Kerri Sandoval
Kerri Sandoval

Trn Desc: RG 91565 POD8

File Number: RG 91565
Trn Number: 450026

S:/PROJECTS/ES09.0215_SFCJC/GIS/MXDS/REPORTS/SVE_PILOT_TEST/SITE_MAP_SOUTH.MXD 901221



Explanation

- Proposed SVE well

Source: Aerial photograph dated November 2, 2009 flown by TRM

Figure 1

Daniel B. Stephens & Associates, Inc.
01/11/2010
JN ES09.0215

SANTA FE COUNTY JUDICIAL COMPELX

Proposed SVE Well Locations

Appendix F

Operation and Maintenance Data Collection

Site: Santa Fe County Judicial Complex **Project No:** ES09.0215.00

☐ **North** ☐ **South** **Staff:** _____

Date/Time on site: _____ **off site:** _____

(use value, no reading (NR), or not active (NA) for each entry)

NATURAL GAS METER READING: _____

Oxidizer System Data

System LEL (%):		Ambient LEL (%):	
FURNACE TEMP (^{O}F):		PANEL TEMP (^{O}F):	
TOTAL FLOW (CFM):		HOURS:	

Operator-Recorded System Data

Sample point	Vacuum (in H2O)	Pressure (in H2O)	Temperature (°F)	Differential Pressure (in H2O)	Flow (cfm)	Conc (ppm-v)
SVE blower influent		NA		NA		
SVE blower effluent	NA				NA	
Oxidizer discharge	NA	NA	NA	NA	NA	
AI blower effluent	NA				NA	NA
Heat exchanger effluent	NA			NA	NA	NA

KNOCKOUT TANK: _____ gallons STORAGE TANK: _____ gallons

North building SVE wells

Well	Vacuum (in H2O)	Flow (cfm)	Conc (ppm-v)
H-1			
H-2			
SVE-8			
SVE-9			

South building AI wells

Well	Pressure (in H2O)	Flow (cfm)	
AI-1			
AI-2			
AIH-1			

South building SVE wells

Well	Vacuum (in H2O)	Flow (cfm)	Conc (ppm-v)
H-1			
H-2			
SVE-1			
SVE-3			
SVE-4			
SVE-6			
SVE-7			
CMW-4			

NOTES AND LABORATORY SAMPLES COLLECTED:

Appendix G

Health and Safety Plan

Site-Specific Health and Safety Plan

Santa Fe County Judicial Complex Site
Santa Fe, New Mexico

Reviewed by: _____ Date: _____
Site Health and Safety Officer

Approved by: _____ Date: _____
Project Manager

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List of Appendices

Appendix

Site-Specific Health and Safety Plan

Project Name: Santa Fe Judicial Complex Site
Project Location: Santa Fe, New Mexico
DBS&A Project Manager: Michael McVey

1. Introduction

This health and safety plan (HSP) establishes the responsibilities, requirements, and procedures for Daniel B. Stephens and Associates, Inc. (DBS&A) personnel while performing surface and subsurface investigations at the above-named site.

The objective of this HSP is to establish a safe work environment for all site personnel, provide a uniform and concise plan of action in an emergency, and furnish the necessary guidance to adhere to these policies. This HSP meets the requirements set forth by the Occupational Safety and Health Administration (OSHA) in 29 Code of Federal Regulations (CFR), Part 1910.120 (Hazardous Waste Operations and Emergency Response, Occupational Safety and Health Standards) and 29 CFR, Part 1926 (Safety and Health Regulations for Construction). This HSP is designed to augment the health and safety policies and procedures established in the DBS&A Health and Safety Program Manual (H&S Manual).

Safety is considered a priority during all field activities. Field personnel will not perform any task for which they have not received adequate training, or which they personally feel is unsafe.

2. Description of Site Activities

During this project, DBS&A will perform hydrogeologic investigations and remediation at the site. This HSP addresses the hazards associated with the following activities:

- drilling, installation, and development of monitor wells

- soil sampling
- groundwater sampling
- jet grouting and column excavation
- remediation system installation

The hazards associated with these activities and the measures that will be employed to protect worker safety are described in Sections 4 and 5. Assuming that the site tasks do not change and that data from follow-up testing do not change the hazard assessment, this HSP will also apply to any subsequent field events. This HSP must be revised to address activities beyond those described in Section 5.

The specific field activities are described in detail in the Work Plan for Additional Site Investigation and SVE Pilot Testing, the Work Plan for Installation of a Jet Grout Barrier, and the Final Remediation Plan for the Judicial Complex Site, Santa Fe, New Mexico. The site-specific field methods and procedures are based on standard operating procedures established by DBS&A and on applicable regulatory agency guidance.

Special site entry procedures:

- The suspect sites are considered to be uncontrolled hazardous waste sites. All workers and visitors are subject to the OSHA requirements for hazardous waste workers in 29 CFR 1910.120.
- Workers must be aware of traffic and pedestrians entering and exiting the site.

Nearest telephone:	DBS&A and Contractor vehicles
Nearest water:	Potable water will be supplied
Nearest fire extinguisher:	DBS&A and Contractor vehicles

Nearest first aid kit: DBS&A and Contractor vehicles

Warning/method signal for site evacuation: Verbal

3. Project Personnel

The DBS&A Health and Safety Manual establishes the roles and responsibilities for health and safety at various levels within the company. The following DBS&A personnel are responsible for the activities at the site:

3.1 Project Manager

The Project Manager (PM) is Michael McVey. The PM is responsible for implementing the DBS&A H&S Program at the site and designating the Site Safety Officer. The PM will oversee the preparation of this site-specific HSP, ensuring that the hazards associated with each task have been identified and that appropriate protective measures have been established.

3.2 Site Safety Officer

The Site Safety Officer (SSO) is Daniel B Stephens & Associates/EA Engineering. This section describes the responsibilities of the SSO in detail because of their critical role in protecting worker health and safety at the site.

The SSO will be responsible for ensuring that all personnel entering an active work area comply with this HSP, meet appropriate OSHA medical and safety training requirements, and utilize the required level of personal protective equipment (PPE). The SSO will conduct site safety meetings prior to the start of work and before the start of each new activity. Workers will acknowledge their attendance by signing the safety meeting sign-off sheet (Appendix A). Accidents or incidents at the job site that affect or could potentially affect worker safety will be documented using the DBS&A accident/incident report form (Appendix A).

In accordance with the Hazard Communication standard (29 CFR 1910.1200), the SSO will coordinate with contractor representatives to identify hazardous materials being used on the site and to ensure that material safety data sheets (MSDSs) are available for each material. Site workers will be briefed on hazardous materials at the job site. The SSO will maintain MSDSs for the hazardous chemicals routinely used on site; the contractor will maintain MSDSs for the hazardous chemicals it brings to the site.

In order to maintain a safe job site, all potentially dangerous conditions or practices must be corrected before proceeding with field work. The SSO will notify contractors and the PM of any unsafe work practices, and will reserve the right to stop all work on DBS&A projects if contractors do not abide by this plan.

The SSO will establish the initial level of PPE and respiratory protection and shall have the authority to upgrade or downgrade levels of protection at any time in response to field conditions. Information and guidance concerning the PPE Program and the Respiratory Protection Program are found in the DBS&A H&S Manual.

The SSO will establish the physical limits of the work areas at the site and shall instruct all personnel and visitors on the boundaries of the exclusion zones. Only authorized personnel will be allowed in active work areas. It is also the responsibility of the SSO to ensure that all personnel enter and leave active work areas through the decontamination station, if necessary. Specific site control measures are addressed in Section 9 of this plan.

3.3 Site Workers and Visitors

Additional workers and visitors may be authorized to enter the site under the direction of the PM or the SSO. All workers must be properly trained in their assigned duties, including standard safety procedures. All workers and visitors entering the work zone will be familiar with the contents of this site HSP and will sign the plan acceptance form (Appendix A). Constructive comments regarding the HSP should be directed to the PM, the SSO or the DBS&A Health and Safety (H&S) Program Coordinator.

3.4 Contractors

Contractors to DBS&A are obligated to conform with OSHA regulations and standard industry safety practices for their profession. If a subcontractor proposes changes in the HSP, the SSO shall obtain permission from the H&S Program Coordinator and the DBS&A PM, and this authorization shall be documented in the project site log. A modification to the HSP will be issued reflecting the changes. Additional contractor responsibilities are described in Section 14 of the DBS&A H&S Manual.

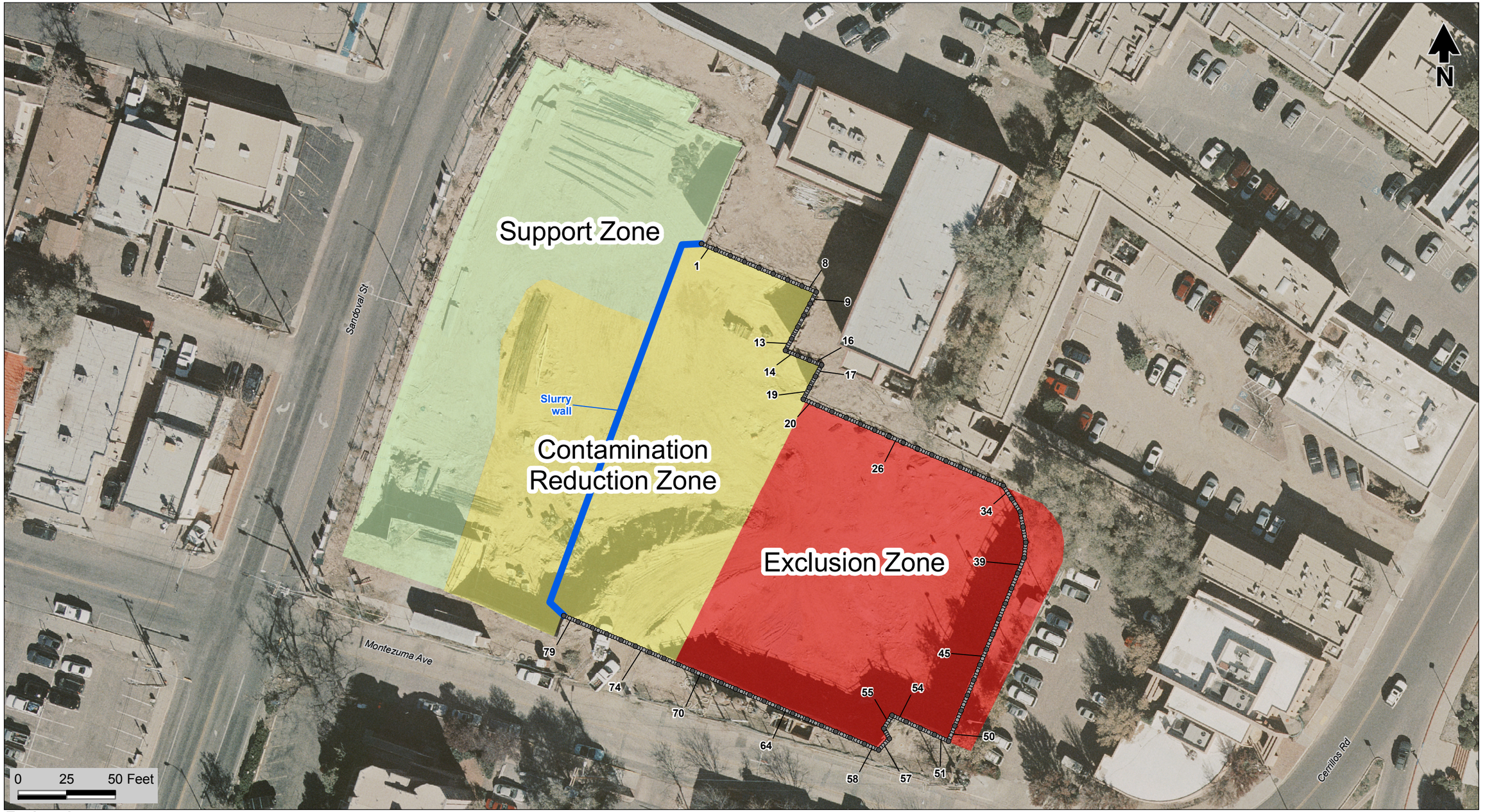
3.5 Work Zones

Work zones will be established at the site including a support zone, a contamination reduction zone, and an exclusion zone. Each zone will be clearly indicated with signage and a map (see Figure 1). Each of the work zones will be posted in conspicuous locations at the site.

The support zone will include the ramp and a staging area at the bottom of the ramp. "Authorized Personnel Only" signs will be posted at the top of the ramp. Personnel making essential equipment and supply deliveries will be permitted in the support zone with a site worker (RECON or DBSA personnel) escort.

The established contamination reduction zone will provide a buffer zone between the support zone and the exclusion zone. The contamination reduction zone will include the area where the mix plant and supporting equipment are staged (east of the ramp) and extend east to the boundary with the exclusion zone (a line from bay 20 south to bay 71). OSHA Hazwoper 24-hour training is required to enter the contamination reduction zone. Hazards in this area are high-pressure systems and heavy equipment.

The established exclusion zone will encompass the east end of the excavation, and therefore the onsite portion of the NAPL plume, as well as the fenced-in area east of the excavation. The exclusion zone is bounded on the west by the boundary with the contamination reduction zone. Access will be limited to essential trained personnel only.



Source: Aerial photograph dated November 2, 2009 flown by TRM

Explanation

26 Bay number

Grouted soldier pile

Jet grout element

Soldier pile

Slurry wall

S:/PROJECTS/ES09.0215_SFCJC/GIS/MXDS/HSP EXCLUSION ZONES.MXD 011020

Daniel B. Stephens & Associates, Inc.
02/01/2010 JN ES09.0215

SANTA FE COUNTY JUDICIAL COMPLEX

HAZWOPER Work Zones

Figure 1

4. General Hazard Review and Assessment

The hazard review for the site is based on DBS&A's extensive experience conducting similar field operations at similar sites.

Physical Hazards	Yes ___X__	No _____	Unknown _____
Toxic Vapors	Yes _____	No _____	Unknown ___X__
Toxic Liquids	Yes _____	No _____	Unknown ___X__
O_2 Depletion	Yes _____	No ___X__	Unknown _____
Radiation	Yes _____	No ___X__	Unknown _____
Heavy Equipment	Yes ___X__	No _____	Unknown _____
Electrical	Yes ___X__	No _____	Unknown _____
Buried Utilities	Yes ___X__	No _____	Unknown _____
Explosion	Yes _____	No _____	Unknown ___X__
Insects and Vermin	Yes ___X__	No _____	Unknown _____
Confined Spaces	Yes _____	No ___X__	Unknown _____

Previous experience indicates a moderate hazard rating for the proposed activities.

4.1 Chemical Hazards

It can be reasonably anticipated that a range of levels of gasoline- or other fuel-related organic compounds, including phase-separated hydrocarbons (PSH), may be encountered within the soil and groundwater underlying the site. The tables in Appendix B provide information on the physical and chemical characteristics, symptoms of exposure, and first aid procedures for each of the compounds of concern.

The Occupational Health and Safety Administration (OSHA) permissible exposure limits (PELs) and the American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLVs) for compounds known or suspected to be present at the site are also presented

in Appendix B. The PEL and TLV are exposure levels whereby workers may be exposed for 8 hours per day, 5 days per week for one's working lifetime without resulting in adverse health effects.

Personnel should approach the site activities with an awareness of the potential hazards associated with dermal contact and ingestion of contaminated soils or liquids, and inhalation of dusts and organic vapors containing petroleum-based contaminants. Engineering controls, air monitoring, safe work practices, and appropriate PPE will prevent contact with or inhalation of contaminated material.

4.2 Physical Hazards

Physical hazards at the site include the typical hazards associated with work around heavy equipment, open excavations, pressurized hoses, vehicular traffic, heat stress, and trips, falls and slips. Site workers must be aware of all machinery and vehicles operating at the site and in the general vicinity. Mechanical hazards must be avoided to the greatest extent possible, and all driving must be performed in a safe manner. Since the site is located in downtown Santa Fe, traffic around the site is expected to be heavy and special attention must be paid by all personnel to any activities in or near public streets. Personal awareness, appropriate PPE, and standard safety procedures will minimize the risk of exposure and physical injury.

4.3 Sunburn and Temperature Hazards

Sunburn is perhaps the most common hazard for field site workers. Sunburn is caused by overexposure to ultraviolet (UV) radiation from the sun. Chronic overexposure to sunlight, especially the UV-B component, accelerates skin aging and increases the risk of skin cancer. The following guidelines can be used to avoid overexposure to UV rays from the sun:

- Wear protective clothing (long sleeves, hats with protective brims, and long pants) that provide the most coverage, and are consistent with the job to be performed.

- Protect eyes with UV-absorbing sunglasses or tinted safety glasses.

- Use a commercial sunscreen with a skin protection factor (SPF) of at least 15 and protection against both UV-A and UV-B rays. Sunscreen should be applied 15 to 30 minutes before exposure and reapplied at 60 to 90 minute intervals. If possible, avoid exposure to the sun between 10:00 a.m. and 2:00 p.m., because rays are the most powerful during this period.

Heat stress is often the most critical hazard for field site workers. The effects can range from transient heat fatigue to serious illness and even death. Heat stress is caused by a number of interacting factors including environmental conditions, clothing, workload, and the individual characteristics of the worker. Because heat stress is fairly common during the summer and fall, preventive measures and alertness are especially important during these seasons.

Protective clothing and equipment affect the way the body controls its temperature. A previous heat injury (including sunburn) can also increase an individuals susceptibility to further heat injury. Workers who have suffered a previous heat injury or who have a sunburn must be especially vigilant in preventing heat stress and injury.

In order to ensure against heat stress-related problems, personnel will take frequent breaks in shaded areas. Workers will wear loose fitting clothing (except around rotating equipment) and will unzip or remove coveralls during breaks. Cool drinking water with added electrolytes will be made available and sufficient amounts of fluids will be consumed to avoid dehydration.

During hot weather, heat stress monitoring will be part of the daily regimen. DBS&A personnel will count their pulse rate for 30 seconds as early as possible in the rest period. If the pulse rate exceeds 110 beats per minute, the length of the next work period shall be reduced to 20 minutes and the heat stress parameters will be observed again at that time. If the pulse rate at the beginning of the next test period exceeds 100 and the last reading was over 110, the work cycle shall be reduced by one-third. Whenever the pulse rate is elevated, work should not be resumed until the pulse rate is below 100 beats per minute. These heat stress indicators shall be observed at least once every hour.

During cold weather, DBS&A personnel will wear multilayer, wind-resistant outfits and drink warm fluids. Warm shelter will be available during breaks.

4.4 Biological Hazards

Venomous snakes and arthropods (e.g., insects, spiders, ticks, scorpions, and centipedes) create a hazard when their habitats are disturbed. Awareness and avoidance are the best defenses. Fieldwork shall be performed in a manner that minimizes disturbances of these creatures. Should a bite or sting occur, first aid shall be immediately applied and medical treatment sought as soon as possible.

The feces and urine of some desert rodents may be carriers of the hantavirus, and fleas on living or dead animals may carry bubonic plague. Both hantavirus and bubonic plague occur in New Mexico and the southwestern United States. Field workers should avoid all contact with rodent nests, droppings, or bodies. Professional medical treatment should be sought immediately if a worker suffers an animal bite of any kind.

> **Important Note:** If an individual has a history of allergic reactions to insect bites or is subject to attacks of hay fever or asthma, or if they are not promptly relieved of symptoms after first aid is administered, a physician will be called or immediate emergency medical treatment will be sought. In a highly sensitive person, do not wait for symptoms to appear, since delay can be fatal. Any individual with a known allergy to wasps and bees must notify the SSO and/or PM/task leader prior to working at the project site.

4.5 Emergency Response

The Emergency Response (ER) Plan is included as Appendix C. The ER Plan includes instructions and procedures for emergency vehicular access, evacuation procedures for personnel, methods of containing a fire, and instructions on how to handle a variety of specific medical emergencies.

5. Task-Specific Hazard Analysis

This section identifies each major task to be performed at the site, the health and safety hazards associated with the task, and the measures that will be taken to eliminate or minimize potential exposures to site workers.

5.1 Drilling, Installation, and Development of Monitor Wells

This task includes drilling, monitoring well and soil vapor extraction well installation, soil and groundwater sampling. Chemical hazards associated with drilling and sample collection include inhalation and dermal contact with potentially contaminated soil and groundwater, and inhalation of organic vapors. Physical hazards may include typical construction hazards due to work with and around heavy equipment; heat stress; and trips, falls, and slips.

Air monitoring will be conducted during drilling and monitor well installation operations as discussed in Section 7. The minimum PPE for drilling will include steel-toed boots, hard hats, and safety glasses. Hearing protection will be worn while drilling and whenever the noise levels approach 85 decibels (refer to Section 7). Chemical-resistant gloves will be worn when handling samples. Diligent air monitoring and the use of appropriate PPE and standard safety procedures will minimize the risk of exposure and physical injury.

The following safety guidelines and practices can be used to mitigate hazards associated with drilling activities:

- The local utility locator should be contacted to identify and mark the location of any underground cables, pipes, or utility installations in the area of the proposed boring. The location of utilities should be discussed with the property owner to identify private utilities. For additional guidance, please refer to DBS&A's *Underground Utility Locating Guidelines.*

- Before starting work, a tailgate safety meeting will be held with all site workers. The DBS&A PM or Site Supervisor should thoroughly instruct the driller as to the nature of the work to be performed and point out any special safety hazards. The SSO should ask the driller to identify and discuss any hazards associated with his particular equipment. All kill switches and safety devices on the drill rig shall be located and tested prior to drilling.

- A 15-foot radius work area shall be established around the drill rig. All DBS&A field personnel are to maintain a safe distance from the immediate area of the drill rig, and shall enter this work zone only when absolutely necessary for the performance of the task at hand.

- Appropriate and adequate barricades and/or warning lights shall be used to prevent accidental entry by unauthorized persons or vehicles.

- Under no circumstance shall DBS&A personnel become directly involved in drilling operations, other than those immediately required for sample collection and for the performance of vapor monitoring and geologic logging.

- When appropriate, the driller will provide a helper to watch for safety hazards, such as buried lines, overhead hazards, ditches, or posts.

- All equipment must maintain at least 20 feet of clearance from overhead power lines.

- During drilling and monitor well installation all site workers will be aware of and monitor for potentially hazardous levels of toxic vapors that can be displaced from the borehole.

Additional safety guidelines to be considered when working around heavy equipment are provided in Section 7.5.5 of the H&S Manual (DBS&A, 1998).

5.2 Soil Sampling

Soil samples may be collected during drilling operations. Chemical hazards associated with soil sampling include potential inhalation of dusts and organic vapors and skin and eye contact with contaminated material. Physical hazards may include those described in Section 5.1. When necessary, a PID will be used to scan samples for organic vapors. Appropriate PPE for soil sampling will include safety glasses, chemical-resistant gloves, steel-toed boots, and long-legged pants. Use of standard safety procedures will minimize the physical hazards.

5.3 Groundwater Sampling

Site activities will include sampling of groundwater monitoring wells. Prior to sampling, water level measurements will be collected using a water level sounder. Chemical hazards associated with groundwater sampling include potential skin and eye contact with contaminated water and sample preservatives. Physical hazards include slips, trips, and falls; heat stress; and hazards associated with drum handling. Appropriate PPE for groundwater sampling will include safety glasses or goggles, chemical-resistant gloves, steel-toed boots, and long-legged pants. Standard safety procedures will minimize the physical hazards.

5.4 SVE Pilot Testing

Site activities will include pilot testing of site SVE wells. Chemical hazards associated with SVE pilot testing include inhalation of organic vapors. Physical hazards may include typical construction hazards due to work with and around heavy equipment; heat stress; and trips, falls, and slips. Appropriate PPE for SVE pilot testing will include safety glasses or goggles, steel-toed boots, and long-legged pants. Air monitoring will be conducted during pilot testing using a Horiba Gas Meter to monitor organic vapors in the breathing zones of workers and around piping joints. Diligent air monitoring and the use of appropriate PPE and standard safety procedures will minimize the risk of exposure and physical injury.

5.5 Jet Grouting

This task will involve the drilling of soil borings and jet grouting. Chemical hazards associated with jet grouting include inhalation and dermal contact with potentially contaminated soil and groundwater, and inhalation of organic vapors. Physical hazards may include typical construction hazards due to work with and around heavy equipment and high pressure systems; heat stress; and trips, falls, and slips.

Air monitoring will be conducted during jet grouting operations as discussed in Section 7. The minimum PPE for drilling will include steel-toed boots, hard hats, and safety glasses. Hearing protection will be worn while drilling and whenever the noise levels approach 85 decibels (refer to Section 7). Chemical-resistant gloves will be worn when handling samples. Diligent air monitoring and the use of appropriate PPE and standard safety procedures will minimize the risk of exposure and physical injury.

The following safety guidelines and practices can be used to mitigate hazards associated with drilling and jet grouting activities:

- The local utility locator will be contacted to identify and mark the location of any underground cables, pipes, or utility installations in the area of the proposed drilling and jet grouting. The location of utilities should be discussed with the property owner to identify private utilities. For additional guidance, please refer to DBS&A's *Underground Utility Locating Guidelines.*

- Before starting work, a tailgate safety meeting will be held with all site workers. The DBS&A PM or Site Supervisor should thoroughly instruct the site worker as to the nature of the work to be performed and point out any special safety hazards. The SSO should ask the jet grout rig operator to identify and discuss any hazards associated with his particular equipment. All kill switches and safety devices on the jet grouting rig shall be located and tested prior to drilling.

- A 15-foot radius work area shall be established around the jet grouting rig. All DBS&A field personnel are to maintain a safe distance from the immediate area of the jet grouting rig, and shall enter this work zone only when absolutely necessary for the performance of the task at hand.

- Appropriate and adequate barricades and/or warning lights shall be used to prevent accidental entry by site workers and unauthorized persons or vehicles.

- Under no circumstance shall DBS&A personnel become directly involved in jet grouting operations, other than those immediately required for sample collection and for the performance of vapor monitoring.

- When appropriate, the contractor will provide an operator's assistant to help watch for safety hazards, such as buried lines, overhead hazards, ditches, or posts.

- All equipment must maintain at least 20 feet of clearance from overhead power lines.

- The jet grouting rig operator and site workers will be aware of and monitor for potentially hazardous levels of toxic vapors that can be displaced from the borehole during jet grouting.

Additional safety guidelines to be considered when working around heavy equipment are provided in Section 7.5.5 of the H&S Manual (DBS&A, 1998).

5.6 Excavation and Trenching Activities for Remediation System Installation

Any excavation/trenching operations will be performed in accordance with OSHA regulations in 29 CFR, Part 1926, Subpart P (Excavations). Only properly trained contractor personnel will operate excavating equipment; at no time will an employee of DBS&A operate excavating equipment. Site workers should be sure they have eye contact with equipment operators before approaching heavy equipment. Heavy equipment should never be approached nor should work

be performed within an operator's blind spots. DBS&A employees will be familiar with and avoid hazards associated with work near or in trenches.

Excavation and trenching for remediation system installation is not anticipated to exceed 4 feet in depth. If personnel expect to enter a trench or excavation that is greater than 5 feet in depth, the sides of the excavation will be shored or sloped in accordance with OSHA regulations in 29 CFR Part 1926.652.

A "competent person" trained to interpret soil conditions and to identify the proper safety protection devices or procedures needed for each particular situation shall be in charge of all excavation and trenching activities at the job site. The DBS&A competent person shall be designated by the PM and will be familiar with their role and responsibilities (refer to Section 3.8 of the DBS&A H&S Manual [DBS&A, 2003]). All site workers should be familiar with basic soil mechanics related to excavations (refer to Section 7.5.6 of the DBS&A H&S Manual [DBS&A, 2003]) and pay particular attention to identify evidences of distress in the excavation.

The following safety guidelines and practices can be used to mitigate hazards associated with excavation activities:

- Contact the local utility locator to identify and mark the location of any underground cables, pipes, or utility installations in the area of the proposed excavation. Discuss the location of utilities with the property owner to identify private utilities.

- Take additional precautions when excavating a backfilled trench, or when working near railroads, highways, or other sources of vibrations.

- Provide appropriate and adequate barricades and warning lights to prevent accidental entry by site workers, unauthorized persons, or vehicles.

- Do not leave a hazard unguarded. Secure the site or surround the excavation with plastic high-visibility fencing to prevent accidental entry.

- When site workers are required to enter trenches, trenches greater than 5 feet in depth or excavated in soft or unstable materials require wall stabilization by sloping or shoring:

- If the excavation cannot be sloped adequately (usually at 1.5 horizontal to 1 vertical), trench boxes, shoring, sheeting, bracing, or other equivalent methods are required to keep the trench wall from collapsing.

- When workers are required to enter trenches that are 4 feet or greater in depth, an adequate means of exit, such as ladders or steps, shall be provided. Exit points shall be spaced no more than 50 feet apart.

- If the trench is 4 feet or more in depth and hazardous atmospheres exist or could reasonably be expected to exist, the trench shall be considered a confined space. Workers entering the trench shall be properly trained in confined space entries, and atmospheric testing for oxygen content, flammability, and organic or other vapors shall be performed before entering the trench. For additional information on the DBS&A Confined Space Program, refer to Section 2.8 of the DBS&A H&S Manual (DBS&A, 2003) or contact the H&S Program Coordinator.

5.7 Grout Barrier Inspection and Excavation Activities

Any excavation/trenching operations will be performed in accordance with OSHA regulations in 29 CFR, Part 1926, Subpart P (Excavations). Only properly trained contractor personnel will operate excavating equipment; at no time will an employee of DBS&A operate excavating equipment. Site workersshould be sure they have eye contact with equipment operators before approaching heavy equipment. Never approach equipment from or work within an operator's blind spots. DBS&A employees will be familiar with and avoid hazards associated with work near or in excavations. Respiratory fit testing will be performed for all personnel that may be required to work with respiratory protection.

- Excavations for the purpose of inspecting previously installed columns will be installed perpendicular to the existing shoring and the grout barrier. Excavated soils will be stockpiled downwind from the excavator operator and other personnel in the vicinity. The excavation will be sloped on all sides except for the grout barrier side of the excavation.

- When the excavation is complete, an explosion-proof fan will be placed at one end of the excavation to enhance ventilation for a minimum period of five minutes. Vapor concentrations will then be measured using an RKI Eagle 5-Gas Meter.

- If the vapor concentration is less than 20% of the Lower Explosive Limit (LEL), a trench box will be lowered into the excavation. Site workers may assist as necessary with the trench box installation.

- If vapor concentrations are less than 150 ppm (parts per million) above background and oxygen concentrations are at least 19.5%, personnel entering the excavation will require Level C protection with a full-face air purifying respirator. A second site worker, also in Level C protection, will monitor the work in the excavation.

- If the vapor concentrations exceed the excavation standard of 20% of the LEL, a temporary clean soil cap will be installed in the excavation bottom to reduce volatilization of contaminants. Following another 5 minute ventilation period, the vapor levels will be measured again.

- If the vapor concentration is still greater than 20% of the LEL, the excavator operator will install the trench box with no other personnel in the vicinity.

- If vapor concentrations are greater than 150 ppm above background and oxygen levels are below 19.5%, personnel entering the excavation will require Level B protection with supplied air. A second site worker, also wearing Level B protection, will monitor the work in the excavation.

- No one will enter an excavation if the LEL exceeds the excavation standard of 20%.

6. Standard Safe Work Practices

The following guidelines are meant to cover operations by the DBS&A field staff and DBS&A contractors (e.g., the drill crew and support personnel) during field activities at the site. DBS&A contractors may choose to establish and enforce more stringent safety guidelines for personnel under their employ. Health and safety issues for other personnel working or visiting on site *and not involved in the site activities* are the responsibility of the Client and their respective contractors, not DBS&A.

Prior to the initiation of any on-site activities, the SSO will conduct a safety meeting to discuss the contents of this site-specific HSP, describe the field activities, identify any high-risk activities, and familiarize personnel with emergency procedures, including the route to the hospital. The DBS&A field supervisor will establish that all equipment is in good condition. The DBS&A supervisor should properly and thoroughly instruct the subcontractor on exactly what results are to be accomplished and point out all known safety hazards.

During the field activities, all participants will be expected to follow standard safe work practices as outlined below:

- Do not eat, drink, smoke, or chew tobacco in the work area.
- Avoid contact with potentially contaminated substances.
- Report any unsafe conditions to the SSO.
- Be aware of the physical characteristics of investigations, including:
  - Wind direction in relation to the ground zero area

- Accessibility to associates, equipment, vehicles, etc.
- Communication
- Hot zones (areas of known or suspected contamination)
- Site access
- Nearest water sources

- Dispose of all wastes generated during field activities as directed by the PM.

7. Air and Noise Monitoring

This section describes the measures that will be taken to protect workers from exposures to organic vapors and noise during the site activities.

7.1 Air Monitoring

During drilling and excavation activities, the DBS&A SSO or his/her designee will be present to monitor the work area for organic vapors. Organic vapors will be monitored using a PID. All meters will be calibrated daily when in use.

The PID will be positioned so that continuous readings are made of the ambient air immediately adjacent to the borehole or downwind of the excavation. The SSO or his/her designee will also obtain readings of organic vapor concentrations in the breathing zone of the workers. Readings will also be made after each section of drill pipe is advanced and at the working face of the excavation as the excavation progresses. During drilling and jet grouting activities, readings with the PID will be taken at a minimum of once every hour during drilling or jet grouting.

If the organic vapor concentrations in the breathing zone exceed or are anticipated to exceed 5 parts per million (ppm) above background for 5 minutes, continuous monitoring will begin and all DBS&A personnel within the work zone will upgrade to Level C PPE (half- or full-face respirator) until vapor levels dissipate. If the readings remain greater than 20 ppm above background within the breathing zone for one hour, operations will be temporarily halted until vapor levels dissipate. If sustained organic vapor levels ever exceed 200 ppm within the drill stem, borehole, or the breathing space, all personnel will evacuate the work zone and the DBS&A SSO will contact the PM for further instructions. Air monitoring standards for grout barrier inspection are discussed in Section 5.7.

Contractor personnel will be notified of all readings. Subcontractor personnel will be required to comply with all applicable OSHA regulations, including those for workers at hazardous waste sites and those related to the use of appropriate PPE.

All personnel should be aware that the detection capabilities of PIDs may be enhanced or quenched by high humidity or by the presence of certain gases, such as methane. Direct evidence of contamination, such as visible staining of soils or strong odors, should be used to further evaluate these quantitative instrument readings.

7.2 Noise Monitoring

All site personnel who are exposed to noise levels approaching 85 decibels must participate in their companies Hearing Protection Program and must use appropriate hearing protection. The DBS&A H&S Program Coordinator has used a noise meter to survey a variety of equipment that may be used during the site activities and found that work around heavy equipment is most likely to require hearing protection. Noise levels are highest near the engines and compressors, but generally do not exceed 85 decibels in the typical operator locations (e.g., behind the drill rig). When a noise meter is not available, the following rule of thumb should be used: if it seems loud or you cannot carry on a normal conversation, hearing protection should be worn.

8. Protective Equipment

PPE requirements for each task are described in Section 5. At a minimum, the following PPE shall be used by DBS&A personnel while working at the site:

- Steel-toed/steel shanked work boots
- Long pants
- Protective eyewear
- Hard hat (when needed)
- Hearing protection (when needed)

The SSO will have the option of upgrading to Level C PPE if dust levels or concentrations of organic vapors are determined to be greater than previously monitored background levels. Level C PPE will include Level D equipment plus a full-face respirator with organic vapor cartridges and dust/mist prefilters. During excavation for grout barrier inspection, Level B protection may be required at the direction of the SSO. Level B PPE will include Level C equipment plus a full-face respirator with supplied air

Respiratory protection will used if PID readings for organic vapor analysis exceed 5 meter units above background in the breathing zone for 5 minutes, or if unusual or unpleasant odors are detected. Full- or half-face air-purifying respirators (APRs) with organic vapor cartridges will be worn by all personnel within the work zone until vapor levels dissipate below 5 meter units. If detector tubes are used to confirm that the concentration of benzene is below the TWAs listed in Appendix B (i.e., 1 ppm for benzene), then work can continue without APRs in atmospheres of up to 10 ppm above background.

Personnel will upgrade respiratory protection to half-face APRs if necessary, as described above. Generally, the protection factors (PF) for half- and full-face APRs are 10x and 50x, respectively. The maximum use limit (MUL) for a given chemical compound is obtained by multiplying the TWA for that compound times the PF for the APR type. Thus, the full-face APR MUL for toluene is 100 ppm x 50 = 5,000 ppm. Tyvek coveralls and/or chemical-resistant gloves will be worn whenever conditions require DBS&A field personnel to come in direct contact with potentially contaminated materials.

8.1 Disposal of Contaminated Clothing or Equipment

All potentially contaminated clothing, Tyvek coveralls, gloves, paper towels, and other expendable items will be placed in garbage bags for disposal. Fresh Tyvek coveralls and work gloves should be donned at the start of each workday or when otherwise required.

8.2 Decontamination Procedures

Specific personnel decontamination procedures are based on the personal level of protection. When using Level D protection, a personnel decontamination system (PDS) is not required. However, because project personnel wearing Level D protection may need to upgrade to Level C if site conditions change, a PDS may be established based on specific site characteristics.

The decontamination stations for Level C decontamination may include: (1) a segregated equipment drop for hand tools and monitoring equipment; (2) a boot and glove wash and rinse; (3) a removal station for gloves and disposable booties (if worn); (4) a removal station for respiratory protection, hard hat, safety glasses, and Tyvek suits; and (5) a station to wash and rinse hands and face. Specific procedures and the sequence of events will be determined based on the potential hazards identified at the specific site. The stations listed are a guide to the selection of adequate decontamination procedures.

When a PDS is set up, the SSO or their designee has the responsibility for operating the decontamination station. This person will make sure that all personnel enter and leave active work areas through the PDS, that all personnel decontaminate properly, and that disposable items are bagged. The SSO will assist on-site workers in changing cartridges, masks, gloves, or other pieces of safety equipment, and monitor the length of work periods. Disposable items will be placed in plastic bags and be properly disposed of. Non-disposable items will be properly cleaned and dried according to manufacturer's specifications and stored for future use.

Decontamination procedures, which are based on guidelines appropriate for low-level contamination, will be required for all reusable equipment used for drilling, sampling, personal protection, and field monitoring. Drilling equipment will be decontaminated between each borehole. Sampling equipment will be decontaminated between each sample. High-pressure steam cleaners, alconox detergent solution, and deionized water rinses may be used. If necessary, personnel will decontaminate equipment at a specified decontamination area before leaving the site. Field monitoring equipment will be cleaned daily; additional cleaning and recalibration will be performed if contamination affects operation.

9. Site Control

The sites are unsecured, with considerable amount of vehicular and pedestrian traffic. Work at the site may require additional site control measures. The SSO will establish the physical limits of the work areas at the site and instruct all personnel and visitors concerning the boundaries of the exclusion zones.

A 15-foot wide primary exclusion area will be established around the perimeter of the drill rig or other active machinery. DBS&A personnel will enter the primary exclusion zone only when absolutely necessary for the performance of the task at hand. A secondary exclusion zone will be established around the general work area. If necessary, the work area will be marked off with temporary barriers and caution tape. Only authorized personnel will be allowed in active work areas.

10. Confined Space Entry

No confined spaces have been identified at the site and no confined space entries are anticipated during the field activities. However, any confined spaces identified as the work progresses shall be properly marked and managed accordingly. DBS&A has developed and implemented a Confined Space Entry Program Plan that provides policies and procedures to be followed for confined space entries, including air monitoring, participant training and duties, and authorizing and permitting confined space entries.

If confined space entries become necessary, the SSO will contact the PM and ensure that entries are performed in accordance with the DBS&A Confined Space Entry Program Plan. If necessary, the SSO will contact the local fire department to coordinate the entry and rescue requirements.

11. Spill Prevention

Minor spills of potentially contaminated soil, residual free product, or groundwater may occur during site work. The area beneath drill rig may be lined with plastic sheeting to control fluid leaks from the equipment. If a spill occurs, site personnel will use best judgement and available materials to contain and prevent it from spreading. All contained soil and liquids will be disposed of in compliance with federal, state, and local requirements.

12. Safety Meetings

A site safety or "tailgate" safety meeting will be held before the start of work for the project and before the start of each new activity. All personnel directly involved in the work are required to attend. This HSP and all pertinent health and safety issues will be discussed during the initial briefing or meetings. The tailgate meeting will also address specific issues regarding on-site health and safety, such as the proposed work and associated hazards, recent problems, and

near-misses. All personnel will acknowledge their attendance by signing the safety meeting form (Appendix A).

13. Training Requirements

Before entering the site, workers will have received the necessary training required by OSHA for workers at potentially hazardous waste sites [29 CFR 1910.120(e)], including 40 hours of formal instruction, and a minimum of 3 days of field experience under the supervision of a trained and experienced worker. Additionally, site supervisors will have completed an 8-hour health and safety supervisor training course. Before starting work, each worker will receive site-specific hazard recognition and emergency response training.

In the event that organic vapor concentrations in the work zone require an upgrade to Level C or Level B PPE, only workers who are trained and medically cleared to wear a respirator will be allowed in the work zone.

DBS&A's contractors will certify, by name, that each of their employees who will perform field work at a hazardous waste project site has received the applicable health and safety training listed above.

14. Medical Monitoring Requirements

All medical monitoring will be performed in accordance with 29 CFR 1910.120(f) and 29 CFR 1910.95 (Occupational Noise Exposure). There are no chemicals of concern that require monitoring (e.g., lead or PCBs) before and after the site activities.

The DBS&A medical monitoring program is directed by Continuum Healthcare (Continuum) in Atlanta, Georgia. In the event of a chemical exposure resulting in symptoms or illness, the SSO may contact Dr. Elaine Thereault at Continuum (800-229-3674) to obtain guidance for recommended testing protocols.

15. Hospital and Evacuation Route

If a medical emergency occurs during work at the site, St. Vincent Regional Medical Center is the closest medical facility. From the site, go south on Cerrillos to St. Francis Drive, go south on St Francis approximately two miles to St. Michael's Drive, east about one half mile to hospital: 455 St. Michael's Drive, Santa Fe (north side of road, see attached map). .

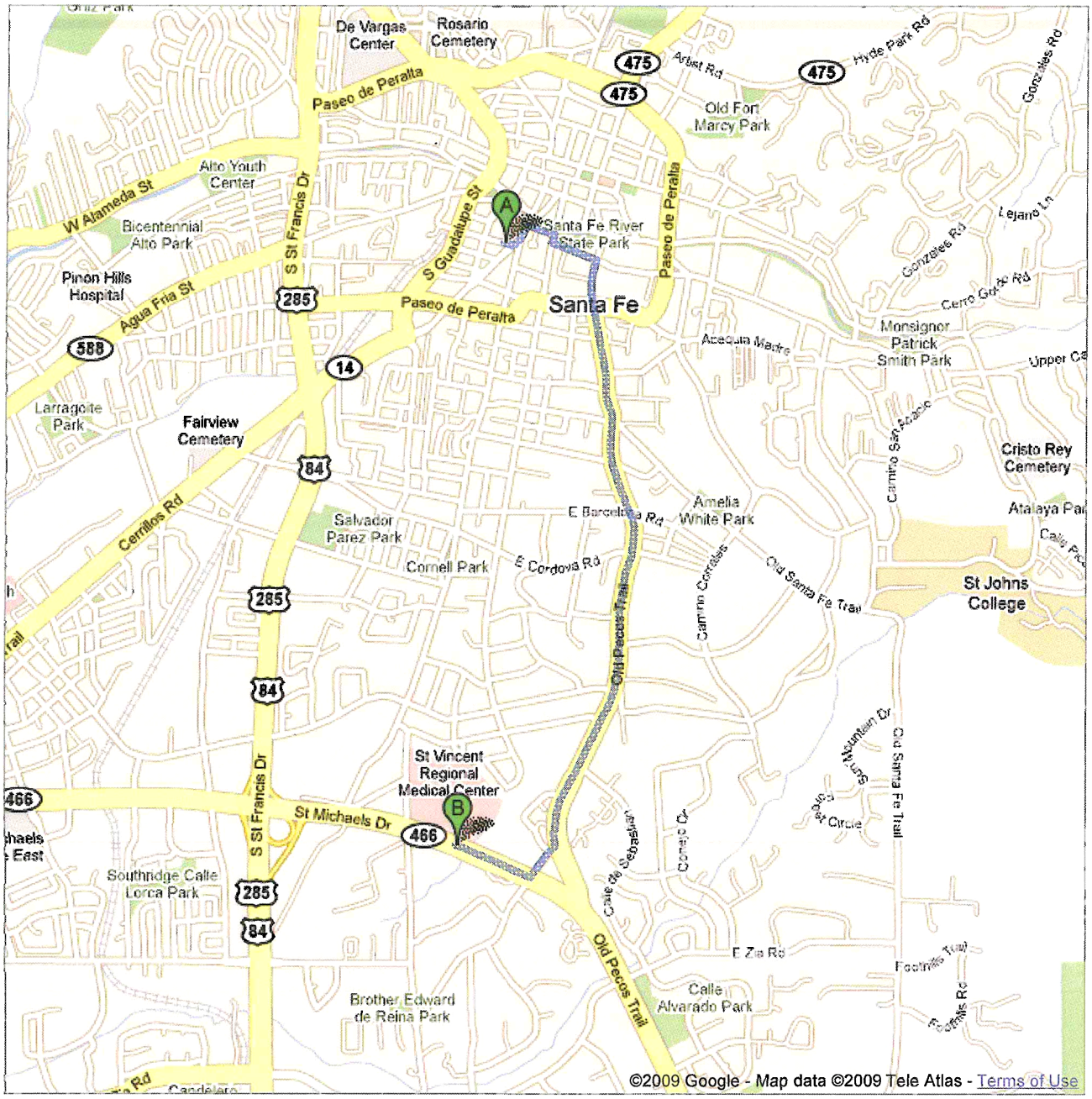
16. Emergency Resources

Location and Number of Nearest Telephone:	DBS&A and Contractor Vehicles
In Case of Fire or Explosion (Telephone Number):	
Call Fire Dept:	911
Call Police/Sheriff:	911
In Case of Personal Injury or Exposure (Telephone Number):	
Call Hospital:	St. Vincent Hospital (505) 983-3361
Call Poison Control Center:	(800) 432-6866
Call Ambulance:	911
Call Air Ambulance:	911
DBS&A and Other Contacts	
DBS&A (Albuquerque):	(505) 822-9400
DBS&A Project Manager:	Michael McVey (office) (505) 822-9400
	(cell) (505) 235-9037
DBS&A New Mexico Environmental Services Manager	
	Jim Kelsey (office) (505) 822-9400
	(cell) (505) 263-2978
DBS&A H&S Coordinator:	Bill Casadevall (505) 822-9400
DBS&A Personnel Department:	Theresa Michael (505) 822-9400
Medical Contact:	Continuum Healthcare (Atlanta, Georgia) (800) 229-3674
Client Contact:	Susan von Gonten NMED PM (505) 984-1909
Regulatory Contact (if appropriate):	Susan von Gonten NMED PM (505) 984-1909
Santa Fe County Property Manager	Joseph Gutierrez (505) 992-9862
200 W. De Vargas Property Manager	Joe Canepa 505) 982-9229
Capitol 66 Property Owner	Matt Champion (505) 983-8459
210 and 218 Montezuma Ave Site Property Manager	Lisa Fray (505) 842-9137
Journal Santa Fe Site Property Manager	Robby Staehlin (505) 263-9580
Emergency Response Telephone Numbers	
Local Chemical Emergency Response Team:	911
National Response Center, Oil & Toxic Chemical Spills:	(800) 424-8802

CHEMTREC (24-hour):	(800) 424-9300

Google maps

Directions to 455 St Michaels Dr, Santa Fe, NM 87505
2.6 mi – about **8 mins**



A 218 Montezuma Ave, Santa Fe, NM 87501

	1. Head **east** on **Montezuma Ave** toward **Montezuma Ave/NM-14**	go 151 ft total 151 ft
14	2. Turn **left** at **Montezuma Ave/NM-14**	go 177 ft total 328 ft
	3. Slight **left** at **Galisteo St**	go 233 ft total 0.1 mi
	4. Turn **right** at **W De Vargas St**	go 479 ft total 0.2 mi
	5. Turn **right** at **Don Gaspar Ave**	go 125 ft total 0.2 mi
	6. Turn **left** at **E De Vargas St**	go 0.1 mi total 0.4 mi
	7. Turn **right** at **Old Santa Fe Trail**	go 0.1 mi total 0.5 mi
	8. Slight **left** to stay on **Old Santa Fe Trail** About 1 min	go 0.4 mi total 0.9 mi
	9. Continue on **Old Pecos Trail** About 3 mins	go 1.3 mi total 2.2 mi
	10. Slight **right** toward **Arroyo Chamiso Rd**	go 371 ft total 2.3 mi
	11. Slight **right** at **Arroyo Chamiso Rd**	go 0.1 mi total 2.4 mi
466	12. Turn **right** at **NM-466/St Michaels Dr** About 2 mins	go 0.3 mi total 2.6 mi

B 455 St Michaels Dr, Santa Fe, NM 87505

Appendices

Appendix A

Health & Safety Forms

Health and Safety Plan Acceptance Form

Instructions: This form is to be completed by each person prior to beginning work at the subject hazardous waste site. THIS FORM IS TO BE RETURNED TO THE DBS&A HEALTH AND SAFETY COORDINATOR.

Project Santa Fe County Judicial Complex

Job No. ES09.0215.00

Location Santa Fe, NM

By my signature below, I acknowledge that I have read and understand the contents of the Health & Safety Plan for this project. I agree to perform my work in accordance with the plan.

Signature	Print Name	Company	Date

Tailgate Safety Meeting

Daniel B. Stephens & Associates, Inc.

Project ID: Santa Fe County Judicial Complex Day: _____

Location: Santa Fe, NM

Project Manager: Mike McVey Team Leader: _____

Health & Safety Officer: _____ No. of Personnel Present: _____

Check Topics Discussed

Scheduled Activities: _____

Chemical/Physical Hazards
- Contaminants of Concern
- Material Safety Data Sheets
- Overhead & Underground Utilities
- Extraordinary Site Conditions
- Lifting/Slips/Trips/Falls
- Heat/Cold Stress (Inc. Sunburn)
- Other: _____

First Aid
- Facilities/Kits/Eyewashes

Personal Protective Equipment - Level D
- Hard Hats/Hearing Protection
- Steel-Toed Boots
- Glasses/Goggles/Shields
- Gloves
- Contingency: Level B or Level C
- Respirators & Tyvek/Saranex

Emergency Procedures/Site Safety
- "Buddy System"
- Communication
- Facility-Specific Regulations
- Rally Point

Vehicle/Heavy Equipment
- Drill Rig "KILL" Switches
- Operation & Inspection
- Preventive Maintenance
- Rotating Augers/Moving Parts

Sanitation & Hygiene
- Drinking Water/Fluids
- Restrooms
- Personal Cleanliness

Housekeeping
- Waste Containers
- Waste Materials
- Waste Water/Decon. Water

Fire Prevention
- Locations of Extinguishers
- Smoking
- Hot Work
- Explosive & Flammable Liquids
- Other: _____

Emergency Facilities (and Directions)

Name: St. Vincent Regional Medical Center

Address: 455 St. Michael's Drive (W to St. Francis, S 2 mi. to St. Michael's Drive, then E .5 mi.)

Tel. No.: 505-913-3361

Safety Meeting Attendees:

Name	Signature	Name	Signature

ACCIDENT/INCIDENT REPORT

This is a supplemental document to the E-1 or TWCC-1 report that needs to be initiated by the employee's supervisor. Please answer all questions completely. This report must be forwarded to the Human Resources office within 24 hours of the injury.

Employee Name_____ Job Title_____

Supervisor_____

Date of Accident_____/_____/_____ Time_____

Location of accident_____

Nature of injuries_____

Cause of accident_____

_____

_____

_____

If employee left work, time of leaving_____

Did employee return to work □ yes □ no If yes, at what time?_____

What is being done to avoid such accidents in the future **[MANDATORY]**_____

_____

_____

_____

Supervisor_____ **Date**_____/_____/_____

Comments on incident and corrective action_____

_____

_____

_____

Manager_____ **Date**_____/_____/_____

Concur with action taken? □yes □no Remarks_____

_____

_____

_____

Health & Safety Coordinator_____ **Date**_____/_____/_____

Chemical Exposure Report

Effective: 08/22/00 ♦ Supercedes: 08/93

Employee Name: _____ Employee Number _____

I believe that I have received or may have received a reportable exposure* to hazardous chemicals:

Date: _____ Project No. _____ Site _____

Details of the Incident: _____

_____

_____

_____

_____

Do chemical hazards exist at the above site which are not properly addressed in the site-specific Health and Safety Plan? Explain. _____

_____

_____

_____

What corrective action has been taken to avoid the potential hazard? _____

_____

_____

_____

_____ _____

Employee Signature/Date Project Manager Signature/Date

* The determination that an incident constitutes a reportable exposure" is based on the informed judgement of the individual, and includes any exposure to chemical substances beyond which would normally occur during proper use of appropriate personal protective equipment (PPE). Examples of reportable exposures would include:

- Dermal contact with free product or contaminated groundwater
- Inhalation of organic vapors in concentrations above the exposure limit
- Eye splash with acids or organic solvents

If in doubt whether a reportable exposure has occurred, discuss the incident with the Project Manager or the DBS&A Health and Safety Officer.

Appendix B

Chemical Hazard Information

Table B-1. Chemical and Physical Properties for Primary Contaminants of Concern

Compound	Vapor Pressure (mm Hg)	Vapor Density [a] (air=1)	Specific Gravity	Odor Threshold[b] (ppm)	LEL (%)	Ionization Potential (eV)	Physical Description
Benzene [Ca]	75	2.7	0.88	8.65	1.2	9.24	Colorless to light yellow liquid with aromatic odor

Source: NIOSH *Pocket Guide to Chemical Hazards* (1997).
[Ca] = Known or suspected carcinogen
[a] Vapor density data from *Groundwater Chemicals Desk Reference* by Montgomery and Welkom (1990).
[b] Odor threshold data from 3M *1999 Respirator Selection Guide*.

Table B-2. Hazard Information for Primary Contaminants of Concern

Compound	Exposure Limit (TWA) (ppm)	IDLH (ppm)	Primary Acute Symptoms from Inhalation and Dermal Exposures	Target Organs	First Aid
Benzene **[Ca]**	1.0 [a]	500	Irritates eyes, skin, and nose; causes headache, nausea, giddiness	Eyes, skin, respiratory system, blood, CNS, bone marrow	As above

Sources: NIOSH *Pocket Guide to Chemical Hazards* (1997) and manufacturer's material safety data sheets (MSDS).

[a] Occupational Safety and Health Administration permissible exposure limit (OSHA PEL).
[b] National Institute of Safety and Health recommended exposure limit (NIOSH REL).

TWA = Eight-hour time-weighted average
ppm = Parts per million
[Ca] = Known or suspected carcinogen
CNS = Central nervous system
CVS = Cardiovascular system
NE = None established

Appendix C

Emergency Response Plan

EMERGENCY RESPONSE PLAN

1. PURPOSE AND SCOPE

The following Emergency Response Plan has been developed to include instruction and procedures for emergency vehicular access, evacuation procedures for personnel, methods of containing a fire, and medical emergencies. All extraordinary conditions that require concise and timely action must be dealt with in a manner that minimizes the health and safety risks to the immediate site personnel and the general public.

2. GENERAL RESPONSE CONSIDERATIONS

All on-site personnel shall be familiar with the Emergency Response Plan described herein. This section will be maintained in the field office.

Due to the nature of the "site", the emergencies or extraordinary conditions that may arise are more than likely limited to personnel accidents requiring first aid, exposure to contaminated sediments, and potential fire near mechanical equipment. The following procedures shall be implemented in the event of an emergency:

- First aid or other appropriate initial action will be administered by those closest to the accident/event. This assistance will be coordinated by the Site Safety Officer (SSO) and will be conducted in a manner so that those rendering assistance are not placed in a situation of unacceptable risk. The primary concern is to avoid placing a greater number of workers in jeopardy;

- Personnel shall report all accidents and unusual events to the SSO, the subcontractor Health and Safety representative, and the Project Manager (PM);

The SSO and other on-site personnel are responsible for conducting the emergency response in an efficient, rapid, and safe manner. The SSO will decide if off-site assistance and/or medical treatment is required and shall be responsible for alerting off-site authorities and arranging for

their assistance. The SSO, in coordination with the contractor Health and Safety representative, will provide to the PM, an Accident/Incident Report that includes the following:

- A description of the emergency (including date, time and duration);
- Date, time and names of all persons/agencies notified and their response;
- Date, time and names of all persons/agencies notified and their response; and
- A description of corrective actions implemented or other resolution of the incident.

All workers on site are responsible for conducting themselves in a mature, calm manner in the event of an accident/unusual event. All personnel must conduct themselves in a manner to avoid spreading the danger to themselves and to surrounding workers.

3. RESPONSIBILITIES

The SSO shall have responsibility for directing response activities in the event of an emergency. He or she will:

- Assess the situation;
- Determine required response measures;
- Notify appropriate response teams; and
- Determine and direct on-site personnel during the emergency.

The SSO shall coordinate the response activities of on-site personnel with those of public agencies.

4. PUBLIC RESPONSE AGENCIES

A list of public response agencies to be contacted and who may, depending on the nature of the situation, assume authority for emergency response is included in the site-specific HSP. The HSP presents local emergency numbers, including local hospitals (which includes the poison control center), ambulance service, fire and police departments, and others. In addition, nationwide hotline numbers for emergency assistance are listed. These phone lists should be retained by all field personnel and posted by the phone in all field trailers.

The hospital location is outlined in the HSP. The SSO will provide directions and/or maps to these facilities to all field personnel.

Prior to the initiation of all on-site work, the local police and fire department will be notified, if deemed necessary. This notification will take the form of a letter describing both on-site and off-site activities. If requested, a briefing will be held to further explain the type of activities and equipment that are associated with each project. Emergency procedures also will be discussed.

5. ACCIDENTS AND NON-ROUTINE EVENTS

Several types of emergencies are outlined in the following subsections. These are not intended to cover all potential situations, and the corresponding response procedures should be followed using common sense. Every accident is a unique event that must be dealt with by trained personnel working in a calm, controlled manner. In the event of an accident/unusual event, the prime consideration is to provide the appropriate initial response to assist those in jeopardy without placing additional personnel at an unnecessary risk. Employees shall be instructed to report all injuries and illnesses to the SSO.

5.1 Worker Injury

If a person working on the site is physically injured, appropriate first aid procedures shall be followed. Depending on the severity of the injury, emergency medical response may be sought. If the employee can be moved, he/she will be taken to the edge of the work area where contaminated clothing (if any) will be removed, and emergency first aid administered. If

necessary, transportation to local emergency medical facility will be provided as soon as possible.

If a worker can only be moved by emergency medical personnel, the SSO will decide what protective equipment, if any, is required to be worn by emergency personnel. Each work area will have extra equipment available for emergencies.

If the injury to the worker involves chemical exposure, the following first aid procedures should generally be initiated as soon as possible.

Eye Exposure

If contaminated solid or liquid gets into the eyes, wash eyes immediately at the emergency eyewash station using water and lifting the lower and upper lids occasionally. Obtain medical attention immediately if symptoms warrant.

Skin Exposure

If contaminated solid or liquid gets on the skin, wash skin immediately at the decontamination station using soap and water. Obtain medical attention immediately if symptoms warrant.

Inhalation

If a person inhales large amounts of organic vapor, move him/her to fresh air at once. If breathing has stopped, perform cardiopulmonary resuscitation (CPR), as per American Red Cross standard first aid instruction. Keep the affected person warm and at rest. Obtain medical attention as soon as possible.

Ingestion

If contaminated solid or liquid is swallowed, medical attention shall be obtained immediately by consulting the Poison Control Center as outlined in the site-specific HSP.

5.2 Temperature-related Problems

Adverse weather conditions are important considerations in planning and conducting site operations. Hot or cold weather can cause physical discomfort, loss of efficiency, and personal injury. One or more of the following control measures shall be employed to help control heat stress:

- Provision for adequate non-alcoholic liquids to replace lost body fluids. Employees must replace water and salt lost through perspiration. Employees will be encouraged to drink more than the amount required to satisfy thirst, since thirst satisfaction is not an accurate indicator of adequate salt and fluid replacement;

- Replacement fluids can be a 0.1 percent salt solution, commercial mixes such as GatoradeTM or Quick KickTM, or a combination of these with fresh water;

- Establishment of a work regimen that will provide adequate rest periods for cooling down;

- Rest breaks are to be taken in a cool, shaded area during hot periods;

- Employees shall not be assigned other tasks during rest periods; and

- All employees shall be informed of the importance of adequate rest, acclimation, and proper diet in the prevention of heat stress.

5.3 Fires

The potential for fires involving hazardous chemicals must be addressed during the preliminary site-specific evaluation of all hazards. Personnel in each work group will be knowledgeable in fire extinguishing techniques. They shall be instructed in proper use and maintenance of the appropriate fire extinguishers supplied at the work site.

5.4 Vehicle Accidents

Posted speed limits will be observed. All vehicles will be required to meet applicable state inspection standards. All drivers will be required to have a good driving record and must have all necessary licenses to operate their vehicle.

The phone numbers of the SSO, the field office, and subcontractor Health and Safety representative will be carried in each vehicle on site. These numbers may also be provided to all police, fire, rescue, and emergency agencies in the area.

Upon notification of an accident, the PM will make available any personnel and equipment at his or her disposal to aid in the cleanup. For example, the following equipment may be supplied:

- sorbent materials to contain/control liquids;
- front-end loaders to pick up solids;
- dust-suppression materials to control dust;
- trucks to haul collected material; and
- appropriate protective gear for cleanup workers.

The supervision and operation of all emergency response personnel and equipment will be coordinated through the authorities at the scene of the accident.

Table of Contents

Section **Page**

Site Health and Safety Plan Summary

This summary provides critical, site-specific information that all site workers should be familiar with. This summary is an integral part of the site-specific health and safety plan (HSP) and must be attached to the complete plan.

Site Name and Location

Santa Fe County Judicial Complex Site, Santa Fe, New Mexico

Project Personnel *(refer to Section 3 for description of duties)*

Project Manager	Michael McVey
Site Safety Officer	Daniel B. Stephens & Associates/EA Engineering
Site Supervisor	Daniel B. Stephens & Associates/EA Engineering

Emergency Response

Table S-1 lists the Emergency Contacts that might be needed in the event of a site emergency. The complete Emergency Response Plan is contained in Appendix C of this plan.

Site Activities and Hazard Assessment

Table S-2 identifies each of the tasks that will be performed during the field program and the hazards associated with each task. Table S-3 identifies the appropriate personal protective equipment (PPE) to be used for each task, including respiratory protection, and the air monitoring equipment that will be used. Air monitoring is further discussed in Section 7.1 of this plan. In the event that new tasks become necessary or new hazards are encountered, the Site Safety Officer will revise Tables S-2 and S-3 accordingly, and notify all site workers of the changes.

Contaminants of Concern

Tables S-4 and S-5 identify the contaminants of concern that might reasonably be encountered during site activities and respectively provide summaries of the chemical properties and worker exposure/health information.

Hospital Route

Figure S-1 depicts the route and provides written instructions from the site to the St. Vincent Regional Medical Center.

Medical Monitoring *(refer to Section 12 of the DBS&A Health and Safety Manual)*

All site workers must be currently participating in a medical monitoring program that includes baseline and annual medical evaluation and testing. Additionally, potential exposures to PCBs require that workers at this site who are involved in drilling or soil sampling activities obtain baseline screening before to participating in those activities.

Site Control Plan *(refer to Section 9 of this plan)*

Site control measures will be implemented during any activity that presents a hazard to workers outside the immediate work area or to unauthorized personnel in the vicinity. These measures can range from erecting barricades or barriers to prevent unauthorized entry, to establishing and enforcing work zones to mitigate the spread of contaminants beyond the work site.

Traffic control plans may be required for all sites where work activities may impact traffic flow on adjacent roadways. These plans must be submitted to and approved by the local traffic control authority. The Project Manager or their designee shall be responsible for ensuring that the necessary site control measures and plans are prepared and implemented.

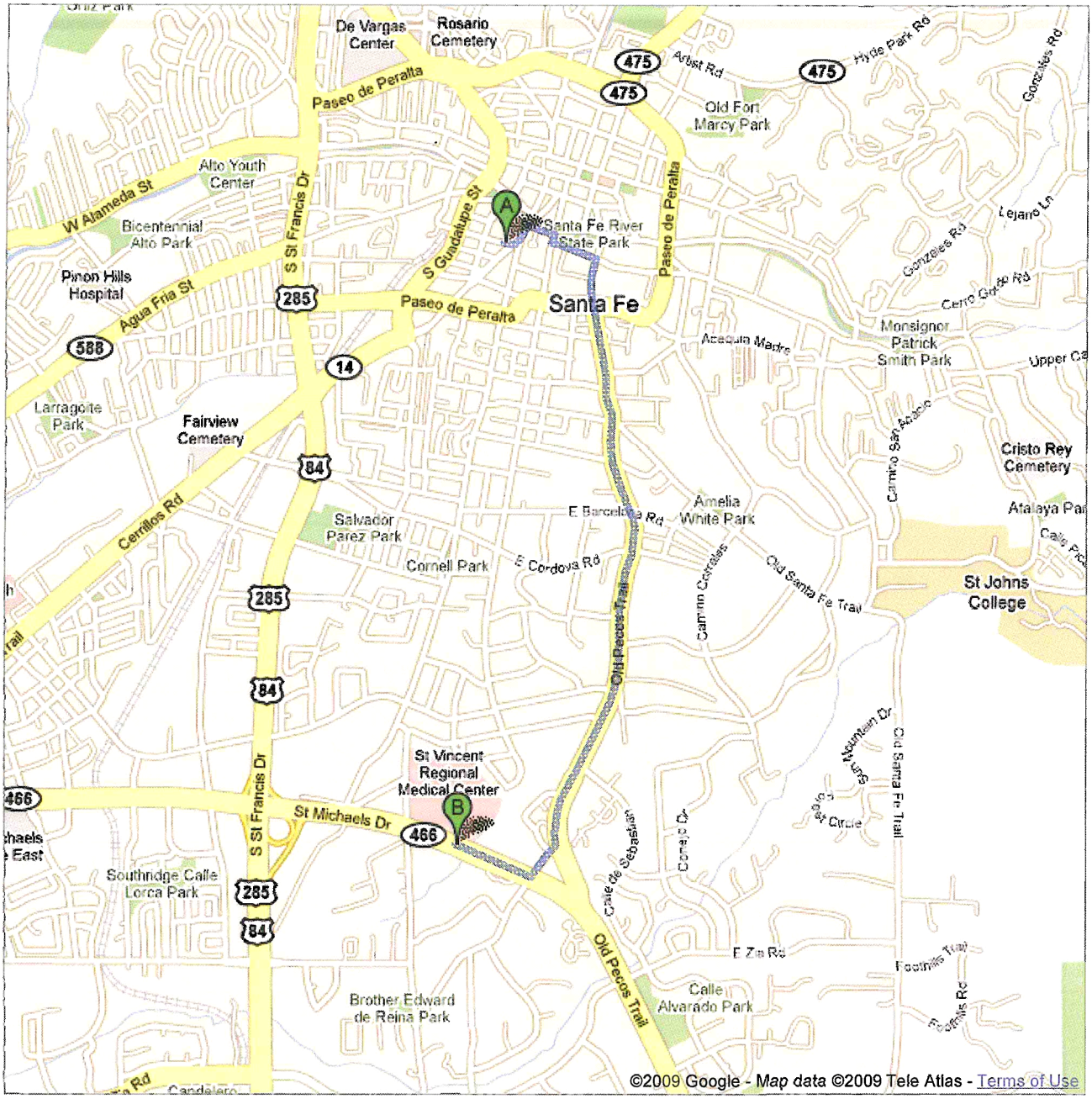
Confined Spaces *(refer to Section 10 of this plan)*

No confined space entries will be performed during the field activities covered by this HSP. In the event that confined space entries become necessary, the entries will be performed by trained personnel in accordance with the DBS&A Confined Space Entry Program.

Google maps

Directions to 455 St Michaels Dr, Santa Fe, NM 87505
2.6 mi – about **8 mins**

Figure S-1



A 218 Montezuma Ave, Santa Fe, NM 87501

	1. Head **east** on **Montezuma Ave** toward **Montezuma Ave/NM-14**	go 151 ft total 151 ft
14	2. Turn **left** at **Montezuma Ave/NM-14**	go 177 ft total 328 ft
	3. Slight **left** at **Galisteo St**	go 233 ft total 0.1 mi
	4. Turn **right** at **W De Vargas St**	go 479 ft total 0.2 mi
	5. Turn **right** at **Don Gaspar Ave**	go 125 ft total 0.2 mi
	6. Turn **left** at **E De Vargas St**	go 0.1 mi total 0.4 mi
	7. Turn **right** at **Old Santa Fe Trail**	go 0.1 mi total 0.5 mi
	8. Slight **left** to stay on **Old Santa Fe Trail** About 1 min	go 0.4 mi total 0.9 mi
	9. Continue on **Old Pecos Trail** About 3 mins	go 1.3 mi total 2.2 mi
	10. Slight **right** toward **Arroyo Chamiso Rd**	go 371 ft total 2.3 mi
	11. Slight **right** at **Arroyo Chamiso Rd**	go 0.1 mi total 2.4 mi
466	12. Turn **right** at **NM-466/St Michaels Dr** About 2 mins	go 0.3 mi total 2.6 mi

B 455 St Michaels Dr, Santa Fe, NM 87505

Table S-1: Emergency Resources

Location and Number of Nearest Telephone:	DBS&A and Contractor Vehicles
In Case of Fire or Explosion (Telephone Number):	
Call Fire Dept:	911
Call Police/Sheriff:	911
In Case of Personal Injury or Exposure (Telephone Number):	
Call Hospital:	St. Vincent Hospital (505) 983-3361
Call Poison Control Center:	(800) 432-6866
Call Ambulance:	911
Call Air Ambulance:	911
DBS&A and Other Contacts	
DBS&A (Albuquerque):	(505) 822-9400
DBS&A Project Manager:	Michael McVey (office) (505) 822-9400
	(cell) (505) 235-9037
DBS&A New Mexico Environmental Services Manager	
	Jim Kelsey (office) (505) 822-9400
	(cell) (505) 263-2978
DBS&A H&S Coordinator:	Bill Casadevall (505) 822-9400
DBS&A Personnel Department:	Theresa Michael (505) 822-9400
Medical Contact:	Continuum Healthcare (Atlanta, Georgia) (800) 229-3674
Client Contact:	Susan von Gonten NMED PM (505) 984-1909
Regulatory Contact (if appropriate):	Susan von Gonten NMED PM (505) 984-1909
Santa Fe County Property Manager	Joseph Gutierrez (505) 992-9862
200 W. De Vargas Property Manager	Joe Canepa 505) 982-9229
Capitol 66 Property Owner	Matt Champion (505) 983-8459
210 and 218 Montezuma Ave Site Property Manager	Lisa Fray (505) 842-9137
Journal Santa Fe Site Property Manager	Robby Staehlin (505) 263-9580
Emergency Response Telephone Numbers	
Local Chemical Emergency Response Team:	911
National Response Center, Oil & Toxic Chemical Spills:	(800) 424-8802
CHEMTREC (24-hour):	(800) 424-9300

Table S-2: Hazard Assessment and PPE and Monitoring Requirements

Potential Hazards	*Proposed Tasks*				
	Drilling, well installation, and development	Soil Sampling	Groundwater Sampling	Jet Grouting	Construction Excavation/ Trenching
Heavy equipment	X			X	X
Hazardous energy	X			X	X
Pinch points	X			X	X
Unstable ground					X
Noise hazards (>85 dbA)	X			X	X
Eye hazards	X	X	X	X	X
Head hazards	X			X	X
Dermal contact	X	X	X	X	X
Slips, trips, and/or falls	X	X	X	X	X
Heavy lifting	X	X	X	X	X
Vehicle traffic	X	X	X	X	X
Unauthorized site entry	X			X	X
Buried utilities	X	X			X
Overhead utilities	X				X
Respiratory Concerns					
Particulates	X	X		X	X
Vapors and/or gases	X	X	X	X	X
Oxygen depletion					
Asbestos					
Contaminated soil or liquids	X	X	X	X	X
Explosive atmospheres					
Heat/cold stress	X	X	X	X	X
Sunburn	X	X	X	X	X
Electrical hazards					
Compressed air or gases	X		X	X	
Fire hazards (hot work)	X				X
Chemical hazards (other than COCs)			X		
Insects and vermin	X	X	X	X	X
Confined spaces					
Ionizing Radiation					
HAZARD RANKING (Low, Medium, High)	Medium	Low	Low	Medium	Medium

Definitions:
COCs Contaminants of concern

Table S-3: Requirements for Personal Protective Equipment and Air Monitoring

Personal Protective Equipment	*Proposed Tasks*			
	Drilling, well installation, and development	Groundwater Sampling	Jet Grouting	Construction Excavation/ Trenching
Level D (Long pants, shirt, steel-toed boots, and safety glasses	Minimum required for all site activities			
Hard hat	X		X	X
Hearing Protection	X		X	X
Faceshield	X (decon)			
Respiratory Protection	(Selection matrix and cartridge change schedule in Project Files)			
Air supply line, full-face				X
Half-mask with organic vapor/HEPA cartridge	X			
Full-face with organic vapor/HEPA cartridge			X	
Cartridge Change Schedule	8 Hours or End of Shift		8 Hours or End of Shift	
Air Monitoring Equipment				
Photo-ionization detector	X		X	X
Flame-ionization detector				
Combustible Gas Indicator				X
O_2 Monitor				
Colorimetric tubes				
H_2S Detector				
Methane Gas Monitor				
Other _____				

Table S-4. Chemical and Physical Properties for Primary Contaminants of Concern

Compound	Vapor Pressure (mm Hg)	Vapor Density [a] (air=1)	Specific Gravity	Odor Threshold[b] (ppm)	LEL (%)	Ionization Potential (eV)	Physical Description
Benzene [Ca]	75	2.7	0.88	8.65	1.2	9.24	Colorless to light yellow liquid with aromatic odor
Toluene	21	3.18	0.87	1.6	1.1	8.82	Colorless liquid with a sweet, pungent, benzene-like odor
Ethylbenzene	7	4.34	0.87	0.092 - 0.6	0.8	8.76	Colorless liquid with an aromatic odor
Xylene (o-, m-, p-isomers)	7-9	4.34	0.86-0.88	0.62 - 20	0.9-1.1	8.44-8.56	Colorless liquid with an aromatic odor (p-Xylene is a solid below 56°F)
Methyl tertiary butyl ether (MTBE)	8.5 - 10	NA	0.7	Unknown	NA	NA	Clear, colorless, low viscosity liquid with a terpene-like odor
Gasoline [Ca]	38-300	NA	Not listed	0.3	1.4	unknown	Clear liquid with a characteristic odor
1,2-Dibromoethane	12	1.65	1.18	26	NA	9.45	Colorless liquid with sweet odor
1,2-Dichloroethane	64	3.42	1.24	6-40	6.2	11.05	Colorless liquid with mild chloroform-like odor

Source: NIOSH *Pocket Guide to Chemical Hazards* (1997).
[Ca] = Known or suspected carcinogen
[a] Vapor density @ 25°C data from *Groundwater Chemicals Desk Reference* by Montgomery and Welkom (1990) and product material safety data sheets.
[b] Odor threshold data from 3M *1999 Respirator Selection Guide*.
a Lower flammable limit; lower explosive limit not available (NA)

Table S-5. Hazard Information for Primary Contaminants of Concern
Page 1 of 2

Compound	Exposure Limit (TWA) (ppm)	IDLH (ppm)	Primary Acute Symptoms from Inhalation and Dermal Exposures	Target Organs	First Aid
Benzene **[Ca]**	1.0 [a]	500	Irritates eyes, skin, and nose; causes headache, nausea, giddiness	Eyes, skin, respiratory system, blood, CNS, bone marrow	As above
Toluene	200 [a]	500	Irritates eyes and nose; causes headache, weakness, fatigue	Eyes, skin, respiratory system, CNS, liver, kidneys	As above
Ethylbenzene	100 [a]	800	Irritates eyes, skin and mucous membranes	Eyes, skin, respiratory system, CNS	As above
Xylene, o-, m-, p-	100 [a]	900	Irritates eyes, skin, nose and throat; causes dizziness, excitement	Eyes, skin, respiratory system, CNS, GI tract, blood, liver, kidneys (o-, m- and p-Xylene)	As above
Methyl tertiary butyl ether (MTBE)	150 [c]	NA	Irritates eyes, skin, and respiratory tract	Eyes, skin, respiratory system, CNS	As above
Gasoline	300 [a]	N.D.	Irritates eyes, skin and mucous membranes; causes dermatitis	Eyes, skin, respiratory system, CNS, liver, kidneys	As above

Sources: NIOSH *Pocket Guide to Chemical Hazards* (1997) and manufacturer's material safety data sheets (MSDS).

[a] Occupational Safety and Health Administration permissible exposure limit (OSHA PEL).
[b] National Institute of Safety and Health recommended exposure limit (NIOSH REL).
[c] OSHA Short-term exposure limit (STEL); PEL not established
[d] No OSHA PEL established; limits for Stoddard solvent presented as a guide only.

TWA = Eight-hour time-weighted average
ppm = Parts per million
[Ca] = Known or suspected carcinogen
CNS = Central nervous system
CVS = Cardiovascular system
N.D. = Not Yet Determined
NE = None established

Table S-5. Hazard Information for Primary Contaminants of Concern
Page 2 of 2

Compound	Exposure Limit (TWA) (ppm)	IDLH (ppm)	Primary Acute Symptoms from Inhalation and Dermal Exposures	Target Organs	First Aid
1,2-Dibromoethane	0.045	100	Irritates eyes, skin, nose and respiratory tract	Eyes, skin, respiratory system	As above
1,2-Dichloroethane	1	50	Irritates eyes, skin, nose and respiratory tract	Eyes, skin, respiratory system	As above

Sources: NIOSH *Pocket Guide to Chemical Hazards* (1997) and manufacturer's material safety data sheets (MSDS).

[a] Occupational Safety and Health Administration permissible exposure limit (OSHA PEL).
[b] National Institute of Safety and Health recommended exposure limit (NIOSH REL).
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CNS = Central nervous system
CVS = Cardiovascular system
N.D. = Not Yet Determined
NE = None established

Appendix H

Legal Notice Publication

THE SANTA FE
NEW MEXICAN
Founded 1849

Jeanie Stroud
Daniel B. Stephens & Assoc.
6020 Academy NE, Ste. 100
Albuquerque, NM 87109

ALTERNATE ACCOUNT: 01005
AD NUMBER: 00307164 ACCOUNT: 00071244
LEGAL NO: 88577 P.O. #:
77 LINES 2 TIME(S) at 161.70
AFFIDAVIT: 0.00
TAX: 13.04
TOTAL: 174.74

AFFIDAVIT OF PUBLICATION

STATE OF NEW MEXICO
COUNTY OF SANTA FE

I, V. Wright, being first duly sworn declare and say that I am Legal Advertising Representative of THE SANTA FE NEW MEXICAN, a daily newspaper published in the English language, and having a general circulation in the Counties of Santa Fe and Los Alamos, State of New Mexico and being a newspaper duly qualified to publish legal notices and advertisements under the provisions of Chapter 167 on Session Laws of 1937; that the publication # 88577 a copy of which is hereto attached was published in said newspaper 2 day(s) between 01/12/2010 and 01/18/2010 and that the notice was published in the newspaper proper and not in any supplement; the first date of publication being on the 12nd day of January, 2010 and that the undersigned has personal knowledge of the matter and things set forth in this affidavit.

/S/ _____
LEGAL ADVERTISEMENT REPRESENTATIVE

Subscribed and sworn to before me on this 18th day of January, 2010

Notary Mary Margaret Vigil-Weideman

Commission Expires: 11-13-2012

OFFICIAL SEAL
Mary Margaret Vigil-Weideman
NOTARY PUBLIC
STATE OF NEW MEXICO
My Commission Expires: 11-13-12

NOTICE OF SUBMISSION OF REMEDIATION PLAN

Date of Notice: January 12, 2010

Notice is hereby given by Daniel B. Stephens & Associates, Inc. of the submission of a Remediation Plan to the Petroleum Storage Tank Bureau (PSTB), New Mexico Environment Department (NMED), as follows:

1. The Remediation Plan proposes actions to remediate a release of petroleum or petroleum products into the environment.
2. The release occurred at the Santa Fe Judicial Complex, 327 Sandoval Street, and Surrounding Properties including the 210 & 218 Montezuma and Capitol 66 Sites located in Santa Fe, New Mexico.
3. The Remediation Plan proposes to remove gasoline contamination through the use of soil vapor extraction technology. The vapors will be treated using thermal oxidation technology and discharged to the atmosphere.
4. A copy of the Remediation Plan can be viewed by interested parties at the NMED PSTB office located at 1301 Siler Road, Building B, Santa Fe, New Mexico, 87507. In addition, the Final Remediation Plan and all applicable data may be viewed at the following website: http://dbstephens.com/GP/file_access.php
5. Comments on the plan may be sent to the PSTB Project Manager: by mail at New Mexico Environment Department Petroleum Storage Tank Bureau, 1301 Siler Road, Building B, Santa Fe, New Mexico, 87507; by telephone at 505-476-4397; or e-mailed to Comments.PSTB@state.nm.us.

Legal #88577
Pub. Jan. 12, 18, 2010

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Appendix I

Schedule for Implementation of Final Remediation Plan

SFCJC Remedial Action Schedule

Task	Working Days	Start Date	End Date
Final FRP Submittal			2/16/2010
FRP Approval	5 days	2/17/2010	2/23/2010
Mob to site	3 days	2/24/2010	2/26/2010
Trenching/Piping	25 days	3/1/2010	3/31/2010
Horizontal Well Installation	10 days	3/16/2010	3/29/2010
Building Installation	10 days	2/22/2010	3/5/2010
Equipment Installation	10 days	4/7/2010	4/20/2010
Startup	10 days	4/21/2010	5/4/2010
Site Restoration	10 days	4/21/2010	5/4/2010
Phase 1 Operations	262 days	5/5/2010	5/5/2011
Switch over to Phase 2 Configuration	20 days	5/6/2011	6/2/2011
Phase 2 Operations	524 days	6/3/2011	6/3/2013