

2



Entela Western Regional Office
9410 - 95 Street
Edmonton, AB T6C 3X3
Canada

Letter of Finding

Issued To:


Date: November 21 2002

Water Flood Services & Sales Ltd.
130 Perkins Street Box 1490
Estevan, Saskatchewan S4A 2L7

The following products are eligible to bear the field certification label as shown when following the requirements set out in report Fc3218-05



Issued By: Bill Stephenson, C.E.T.

Signature: 

Product: Oil Flood Compressor Package , models listed below:

Model Number	Rated Power	Hertz
TTDJ/CAT	120V Utility's, CD Ignition- Panel	60Hz




Certification : ExnLA de IIA, T1 (Inside), Exna IIA (Outside)

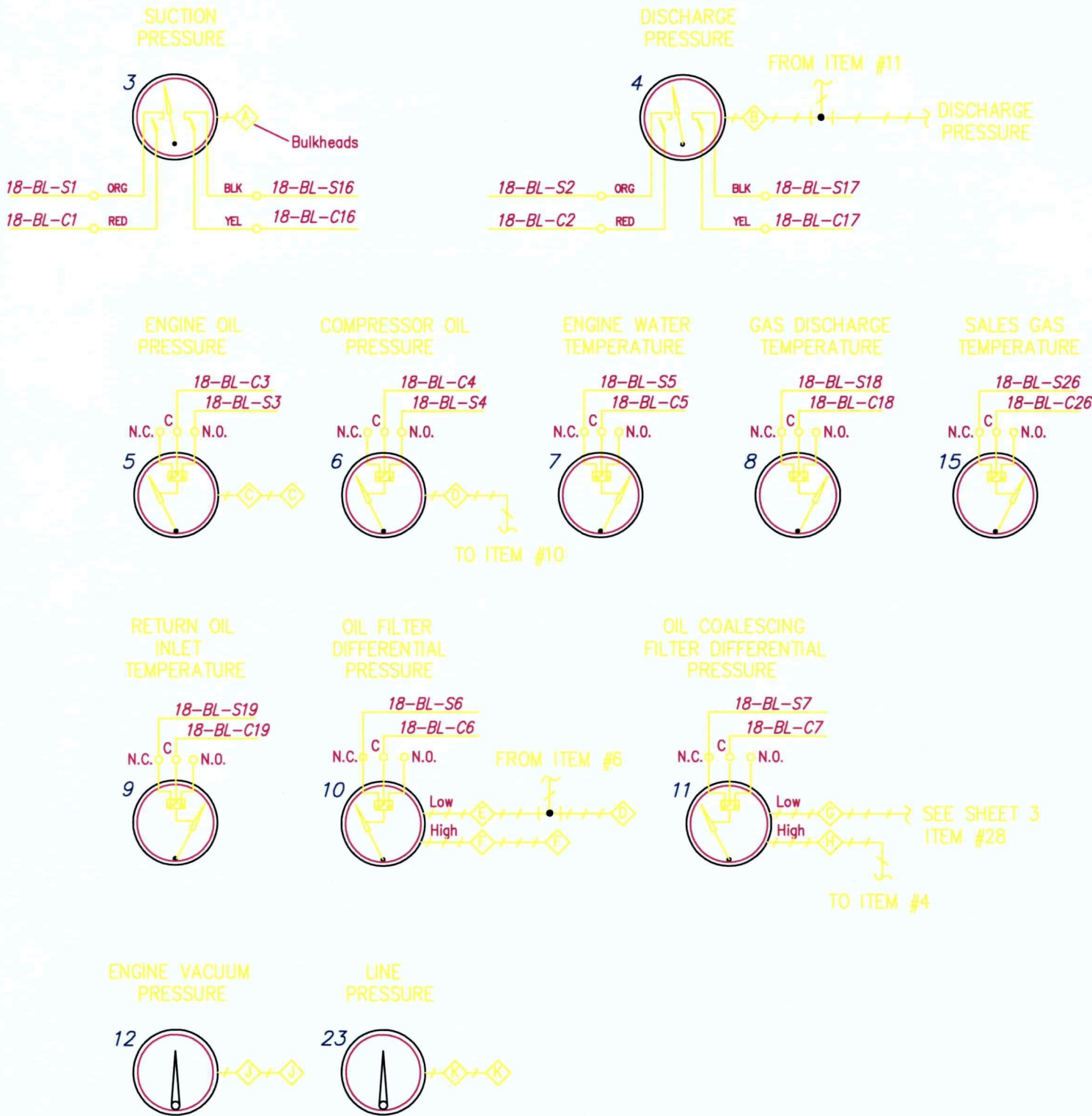
Applicable Requirements:
CSA C22.2 No 213, 14


PANEL LEGEND

ITEM	MFR.	MURPHY PART No.	MODEL NO.	DESCRIPTION
1.	MURPHY	50700112	TTDJ-IGN-T	"SELECTRONIC TATTLETALE" ANNUNCIATOR
2.	UNITED ELECT	00000283	800-4BS-10S-10S	BUILDING AIR TEMPERATURE GAGE
3.	MURPHY	05702713	45APEF-S-60	SUCTION PRESSURE "SWICHGAGE"
4.	MURPHY	05707215	45APEF-S-400	DISCHARGE PRESSURE "SWICHGAGE"
5.	MURPHY	05090122	A25PEF-100-SF15	ENGINE OIL PRESSURE "SWICHGAGE"
6.	MURPHY	05090123	A25PEF-400-SF60	COMPRESSOR OIL PRESSURE "SWICHGAGE"
7.	MURPHY	10701414	A25TEF-250-16-SR210	ENGINE WATER TEMPERATURE "SWICHGAGE"
8.	MURPHY	10090124	A25TEF-300-16-SR220	GAS DISCHARGE TEMPERATURE "SWICHGAGE"
9.	MURPHY	10090123	A25TEF-300-16-SR190	RETURN OIL INLET TEMPERATURE "SWICHGAGE"
10.	MURPHY	05090121	A25DPEF-30-SR15	OIL FILTER DIFFERENTIAL PRESSURE "SWICHGAGE"
11.	MURPHY	05090121	A25DPEF-30-SR15	COALESCING FILTER DIFF. PRESSURE "SWICHGAGE"
12.	MURPHY	05704397	A25VG-30	ENGINE VACUUM "MURPHYGAGE"
13.	TELEMECANIQUE	00007927	ZB4BS54	EMERGENCY SHUTDOWN PUSHBUTTON
14.	TELEMECANIQUE	00007928	ZB4BZ102	CONTACT BLOCK
15.	MURPHY	10090140	A25TEF-160-25-1/2-SR125	SALES GAS TEMPERATURE "SWICHGAGE"
16.	BWB	00009177	"R" PILOT	PRESSURE SENSOR, SET @ 160 psi RISING
17.	BWB	00009176	"R" PILOT	PRESSURE SENSOR, SET @ 155 psi RISING
18.	AMOT	00004852	4229B1C1	PNEUMATIC INDICATOR (2), GREEN/BLACK
19.	SWAGELOK	00009438	SS-6P4T-LD	2 WAY BALL VALVE
20.	VERSA	00006349	VGA-3322-181CC-5116-D048	SOLENOID VALVE
21.	AMOT	00004525	4057D023H1	VALVE (3)
22.	INGERSOLL	00006295	SMGB-618	PUSHBUTTON
23.	McDANIEL	00004897	KHP-GF	LINE PRESSURE INDICATION GAUGE, 400 psi
24.	MURPHY	50225495	-----	VERTICAL LEGEND HOLDER W/303740.XLS INSERT
25.	VERSA	00005407	BSP-3308-316	PNEUMATIC PILOT VALVE
26.	MURPHY	50225417	-----	ENCLOSURE, ENC-P-H-A302408LP-N3-MR
27.	MURPHY	50225726	-----	STAND, STD-P-30X24X9-CP-REV-MR, MTG HOLES
28.	SWAGELOK	-----	KCPIDRA2A2P1000	REGULATOR, 0-25 PSI
29.	IR	39161002	1N4005	DIODE

NOTES:

- FACTORY WIRING: _____
CUSTOMER WIRING: _____
END USER WIRING: _____
TUBING: +-----+
- TUBING: 1/4 x .035 316 STAINLESS STEEL (WELDED)/FLEX
FITTINGS: SWAGELOK STAINLESS STEEL
- LAST WIRE NUMBER USED: 18-GY-53
- "18-BL-25" REPRESENTS "AWG-WIRE COLOR-WIRE NUMBER"
- ROUTE SENSOR LEADS SEPARATE FROM ALL OTHER WIRING.
- MAXIMUM LENGTH OF SENSOR LEADS IS 500 FEET.
- CAUTION: DISCONNECT ALL SENSOR LEADS BEFORE WELDING.
- THIS PANEL IS SUITABLE FOR USE IN CLASS I, DIV. 2, GROUP D HAZARDOUS LOCATIONS.
- GROUND SYMBOLS WILL BE SHOWN PER THE FOLLOWING:
EARTH/POWER CHASSIS/NON-INCENDIVE DC COM/CLOSE LOOP
  
- UNLESS OTHERWISE NOTED ALL DEVICES ARE SHOWN IN THE SHELF POSITION.
- ALL WIRING TO BE 18 GA. UNLESS OTHERWISE NOTED.
- EACH OF THE FIRST 16 INPUTS CAN BE CONFIGURED FOR CLASS A, B1, B2, OR C AND FOR SHUTDOWN OR ALARM. SPARE SHUTDOWNS WILL BE DEFAULTED TO CLASS "A".
- INPUT #29 IS SELECTABLE CLASS "A" OR FOR EMERGENCY STOP (OVERRIDES TEST TIMER)
INPUT #30 IS SELECTABLE REMOTE RESET OR CLASS "A"
INPUT #31 IS REMOTE LOCKOUT OR CLASS "A"
(INHIBITS CLASS "B1" & "B2" LOCKOUT TIMERS)
INPUT #32 TYPICALLY USED FOR EMERGENCY STOP (OVERRIDES TEST TIMER)
DISPLAY #50 IS OVERSPEED (INTERNAL, ON "T" MODEL ONLY)
DISPLAY #51 IS UNDERSPEED/LOSS OF IGNITION (ON "T" MODEL ONLY)
DISPLAY #52 IS MANUAL STOP (INTERNAL)
- SENSOR INPUTS ARE PASSIVE SWITCHES. REMOVE FACTORY INSTALLED JUMPER FOR NORMALLY CLOSED SWITCHES.
- NORMALLY OPEN SENSORS ARE RETURNED TO GROUND TO ACTIVATE ANNUNCIATOR.
- FOR ADDITIONAL INFORMATION REFER TO INSTALLATION BULLETIN.



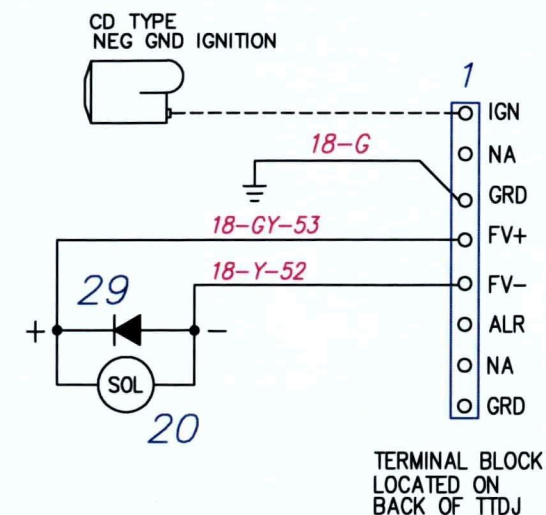
M	NO CHANGES THIS SHEET	05-H383	11-11-05		DRAWN BY	LINDA
L	CHANGED MODEL NUMBER ON ITEM #28	05-H212	06-23-05		CHK'D BY	
K	CHANGED ITEM 28 TO SWAGELOK REGULATOR, 0-25 PSIG	05-H162	5-18-05		APP'D BY	
J	CHANGED ITEMS 3 & 4 TO APEF MODEL "SWICHGAGES"	04-H224	6-14-04		DATE	10-03-02
H	CUSTOMER CHANGE - MODIFIED ITEM 28	04-H215	6-08-04		SCALE	NONE
G	CHANGED ITEM 2 WAS SPLFC-136P10	04-H169	5-11-04			
F	CUSTOMER REQUEST - REVISED ITEM 15	03-H341	9-19-03			
E	REVISED PANEL LEGEND ITEMS 13 & 14	03-H193	5-07-03			
REV.	DESCRIPTION	DCN No.	DATE	CHK'D BY	SHEET 1 OF 3	
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MURPHY MFR. IS NOT RESPONSIBLE FOR COPIES OF THIS DRAWING NOT HAND SIGNED BY OUR ENGINEERS.						
					FOR	
						CONTROL SYSTEMS & SERVICES - ROSENBERG, TX
						WATERFLOOD SERVICE & SALES
						LEGEND & WIRING DIAGRAM
					YOUR NO.	REF NO.
					DWG. NO.	50-30-2668
						REV.
						50-30-3740
						M

INDICATOR READOUTS 303740.xls

CLASS	DISPLAY	DESCRIPTION			
B1	01	LOW SUCTION PRESSURE	01	18-BL-C1 18-BL-S1 18-BL-C2	3
B1	02	LOW DISCHARGE PRESSURE	02	18-BL-S2 18-BL-C3 18-BL-S3 18-BL-C4	4
	03	LOW ENGINE OIL PRESSURE	03	18-BL-S4 18-BL-C5	5
B1	04	LOW COMPRESSOR OIL PRESSURE	04	18-BL-S5 18-BL-C6	6
B1	05	ENGINE WATER TEMPERATURE	05	18-BL-S6 18-BL-C7	7
B1	06	OIL FILTER DIFFERENTIAL PRESSURE	06	18-BL-S7	10
B1	07	HIGH OIL COALESCING FILTER DIFF PRESSURE	07		11
B1	08	LOW COALESCING OIL LEVEL	08		
B1	09	HIGH COALESCING OIL LEVEL	09		
	10	SPARE	10		
	11	SPARE	11		
	12	SPARE	12		
	13	SPARE	13		
	14	SPARE	14		
	15	SPARE	15		
A	16	HIGH SUCTION PRESSURE	16	18-BL-C16 18-BL-S16 18-BL-C17	3
A	17	HIGH DISCHARGE PRESSURE	17	18-BL-S17	4
A	18	HIGH GAS DISCHARGE TEMPERATURE	18	18-BL-C18 18-BL-S18	8
A	19	HIGH RETURN OIL INLET TEMPERATURE	19	18-BL-C19 18-BL-S19	9
A	20	LOW ENGINE COOLANT LEVEL	20		
A	21	LOW ENGINE OIL LEVEL	21		
A	22	ENGINE/COMPRESSOR VIBRATION	22		
A	23	HIGH SCRUBBER LIQUID LEVEL	23		
A	24	SPARE	24		
A	25	LOW BUILDING AIR TEMPERATURE	25	18-BL-25 18-BL-C26 18-BL-S26	2
A	26	HIGH SALES GAS TEMPERATURE	26		15
A	27	COOLER VIBRATION	27		
A	28	SPARE	28		
A	29	EMERGENCY STOP (OUTSIDE)	29		
A	30	SPARE	30		
A	31	SPARE	31		
	32	EMERGENCY STOP (INSIDE)	32	18-BL-C32 18-BL-S32	13,14
A	50	ENGINE OVERSPEED (INTERNAL)	1		
B1	51	UNDERSPEED/LOSS OF IGNITION (INTERNAL)			
A	52	MANUAL STOP (INTERNAL)			

1
TERMINAL BLOCK LOCATED
ON BACK OF TTDJ

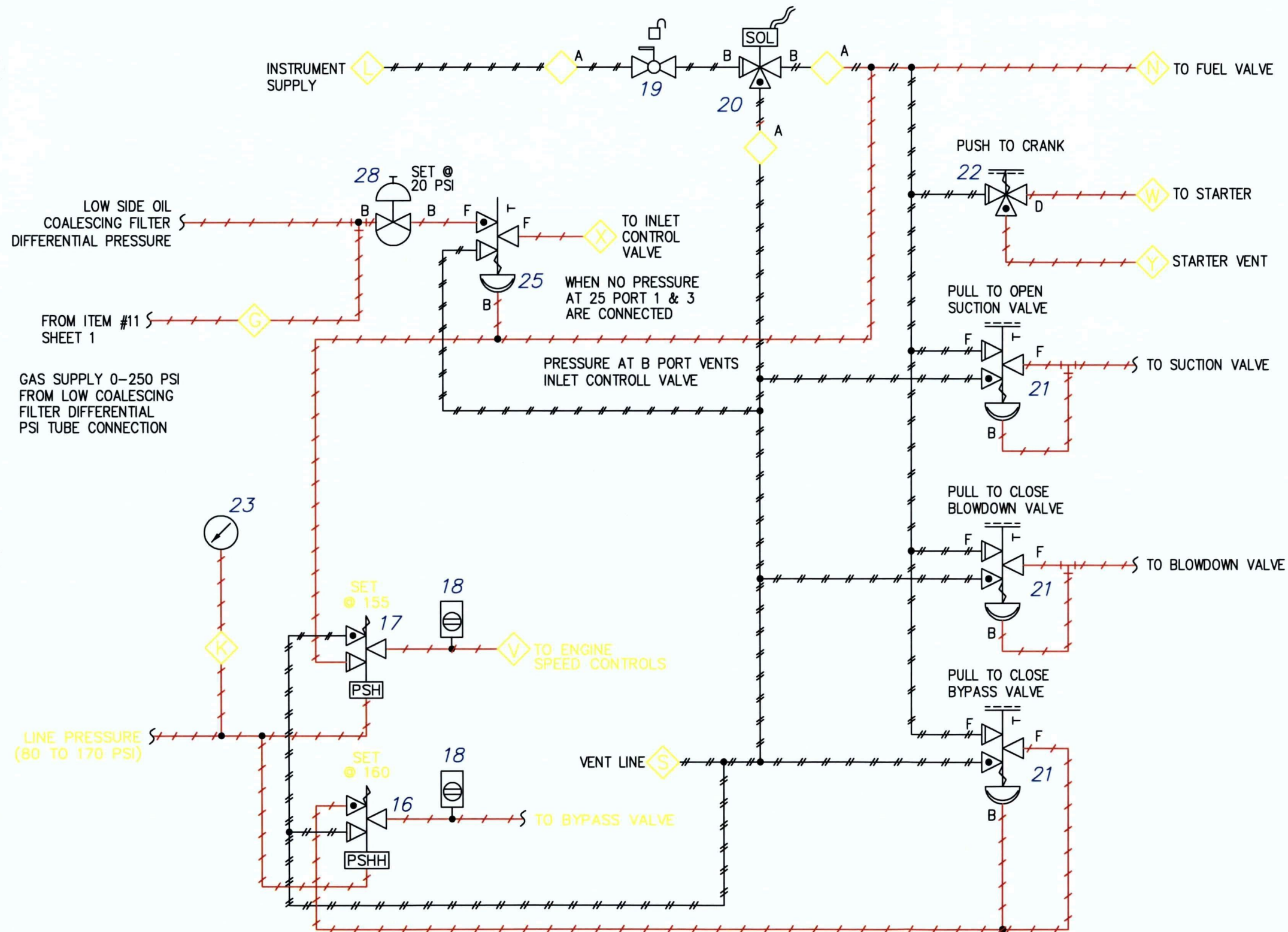
ESD IS DESIGNED FOR ANNUNCIATION
OF SHUTDOWN ONLY. ACTUAL SHUTDOWN
SHOULD BE ACCOMPLISHED BY CUSTOMER'S
SHUTDOWN DEVICE MOUNTED LOCALLY.



M	CUSTOMER REQUESTED CHANGES - REVISED SHUTDOWN LIST	05-H383	11-11-05		DRAWN BY	LINDA
L	NO CHANGES TO THIS SHEET	05-H212	06-23-05		CHK'D BY	
K	NO CHANGES TO THIS SHEET	05-H162	5-18-05		APP'D BY	
J	NO CHANGES TO THIS SHEET	04-H224	6-14-04		DATE	10-03-02
H	NO CHANGES TO THIS SHEET	04-H215	6-08-04		SCALE	NONE
G	NO CHANGES TO THIS SHEET	04-H169	5-11-04		SHEET 2 OF 3	
F	NO CHANGES TO THIS SHEET	03-H341	9-19-03			
E	REVERSED COMMON/SENSOR WIRE NUMBERS	03-H193	5-07-03			
REV.	DESCRIPTION	DCN No.	DATE	CHK'D BY		

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FOR		WATERFLOOD SERVICE & SALES	
WIRING DIAGRAM			
YOUR NO.	REF NO.	50-30-2668	
DWG. NO.	REV.	50-30-3740	



TUBING SCHEDULE

1/4" DIA.

3/8" DIA.

M	NO CHANGES THIS SHEET	05-H383	11-11-05	DRAWN BY	LINDA
L	NO CHANGES TO THIS SHEET	05-H212	06-23-05	CHK'D BY	
K	ADDED BULKHEAD "Y" FOR STARTER VENT	05-H162	5-18-05	APP'D BY	
J	NO CHANGES TO THIS SHEET	04-H224	6-14-04	DATE	10-03-02
H	CUSTOMER CHANGES - MODIFIED ITEM 28	04-H215	6-08-04	SCALE	NONE
G	NO CHANGES TO THIS SHEET	04-H169	5-11-04		
F	NO CHANGES TO THIS SHEET	03-H341	9-18-03		
E	NO CHANGES TO THIS SHEET	03-H193	5-07-03		
REV.	DESCRIPTION	DCN No.	DATE	CHK'D BY	SHEET 3 OF 3

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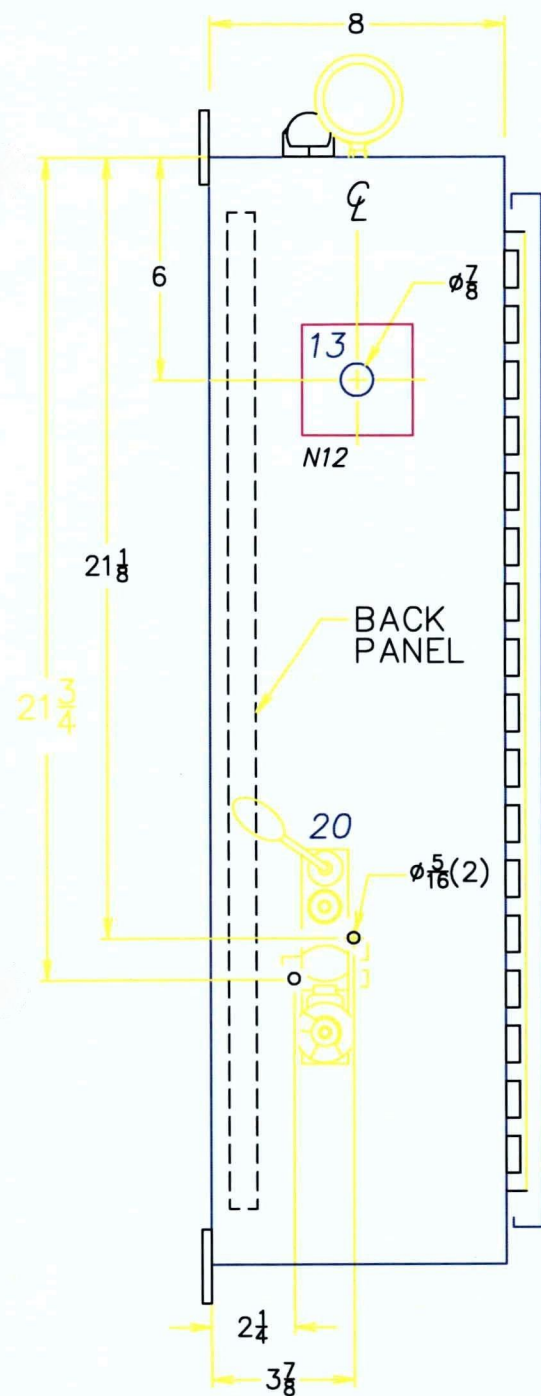
murphy

CONTROL SYSTEMS & SERVICES - ROSENBERG, TX

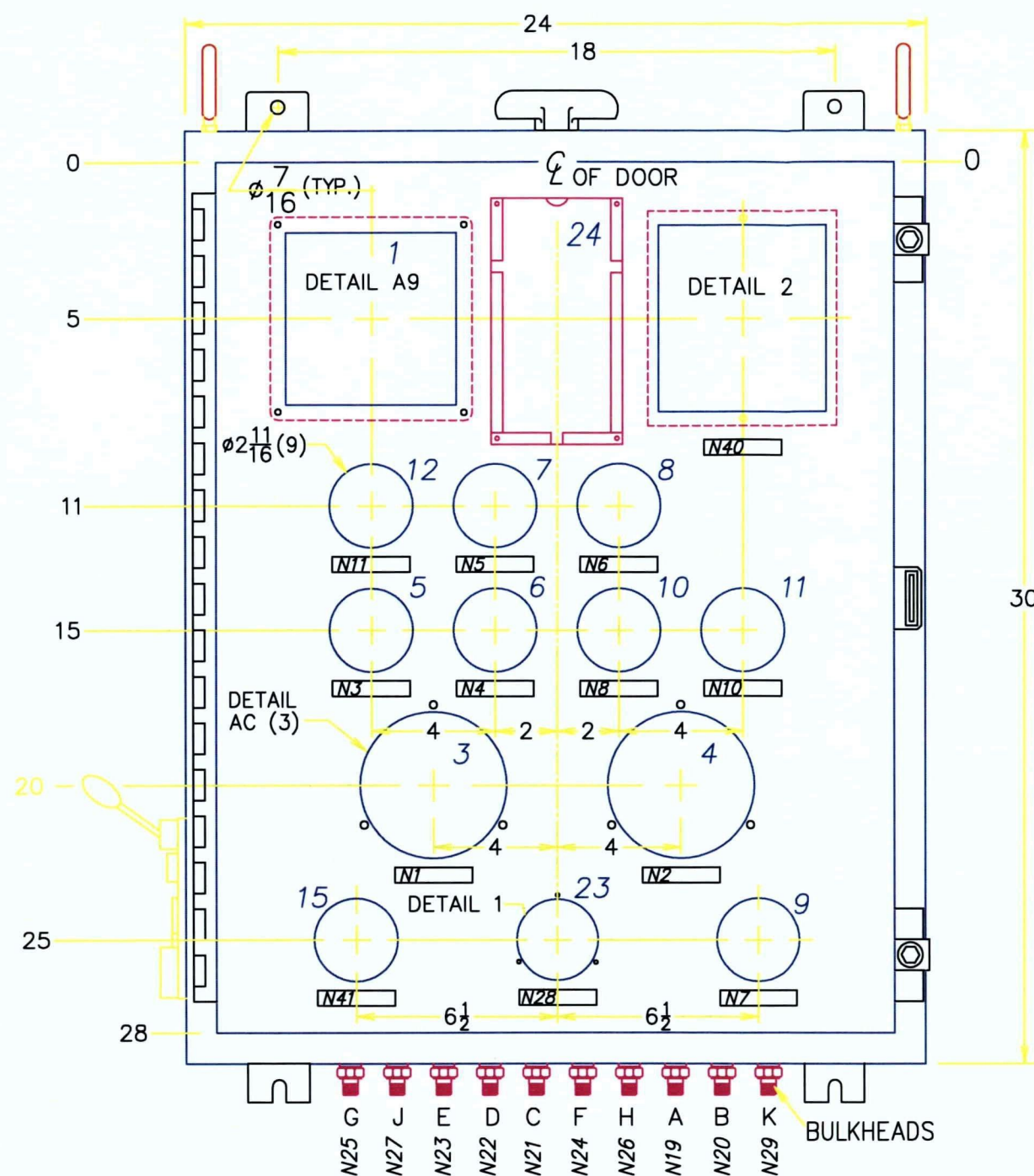
FOR WATERFLOOD SERVICE & SALES PNEUMATIC DIAGRAM

YOUR NO. REF NO. 50-30-2668

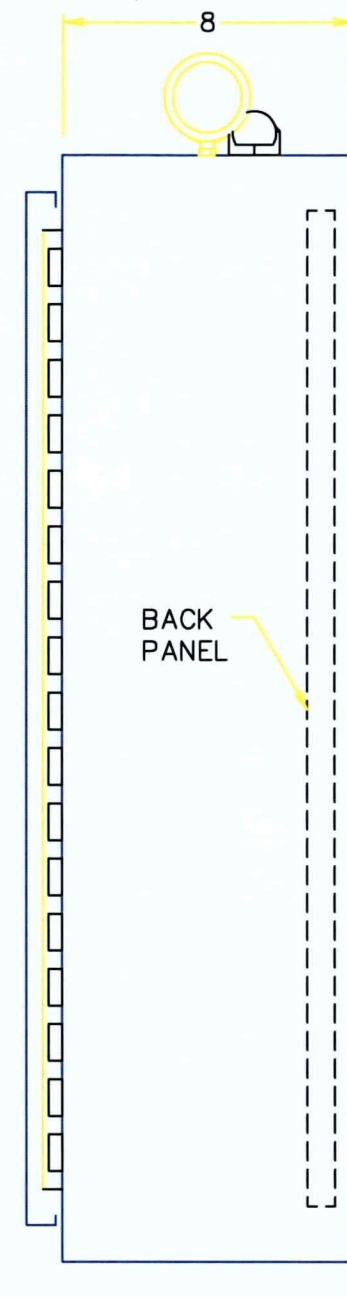
DWG. NO. 50-30-3740 REV. M



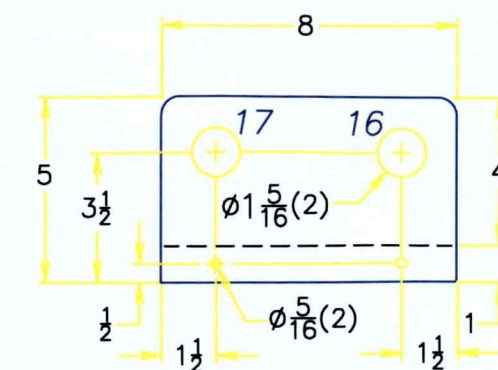
LEFT SIDE VIEW



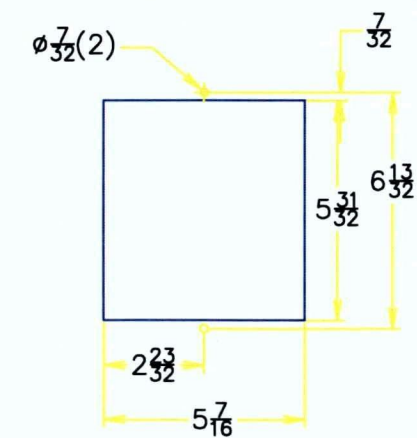
FRONT VIEW



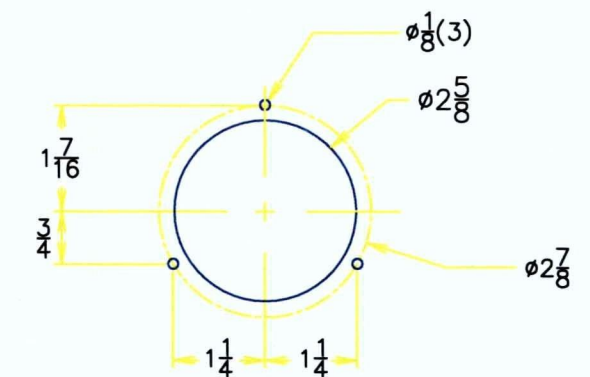
RIGHT SIDE VIEW



PILOT BRACKET




DETAIL 2

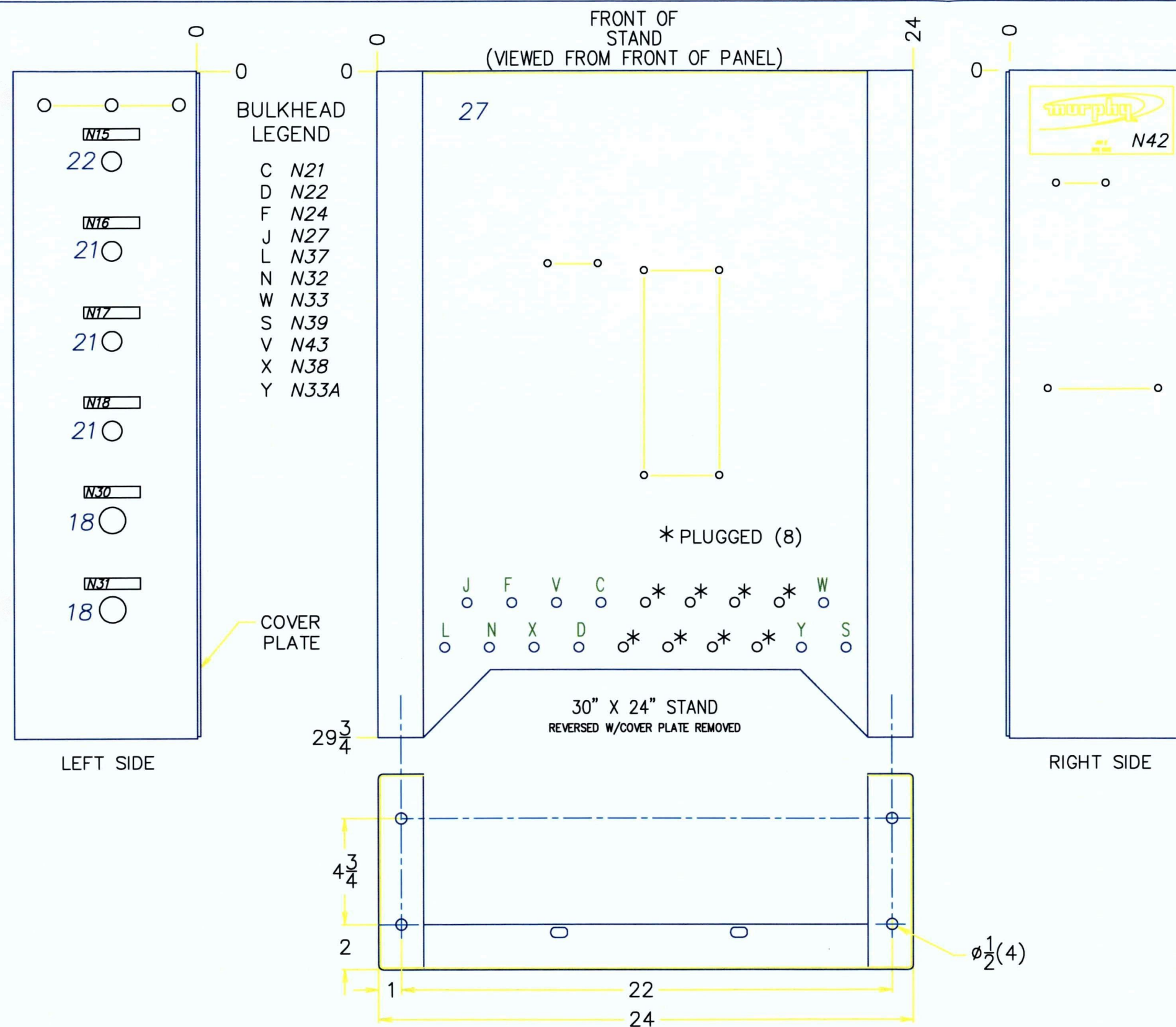


DETAIL 1

ENCLOSURE: HOFFMAN A-243008LP(OR EQUAL)
BACKPLATE: HOFFMAN A-30P24(OR EQUAL)


ITEM NUMBERS CORRESPOND TO PANEL LEGEND
ON DRAWING NO. 50-30-3740

						DRAWN BY LINDA		CONTROL SYSTEMS & SERVICES - ROSENBERG, TX	
						CHK'D BY			
						APP'D BY			
D	NO CHANGES THIS SHEET	05-H162	05-18-05			DATE 10-03-02	FOR	WATERFLOOD SERVICE & SALES	
C	CHANGED ITEM 2, ADDED DETAIL 2	04-H169	05-11-04			SCALE 3/16			
B	ENGR. CHANGE - MOVED ITEM 2; ADDED BRACKET DETAIL		10-30-02						
A	AS BUILT		10-21-02			SHEET 1 OF 2		PANEL LAYOUT	
REV.	DESCRIPTION	DCN No.	DATE	CHK'D BY					
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MURPHY MFR. IS NOT RESPONSIBLE FOR COPIES OF THIS DRAWING NOT HAND SIGNED BY OUR ENGINEERS.									
YOUR NO.							17956-926	OUR NO.	50-30-2668
DWG. NO.							50-29-3740	REV.	D



INDIVIDUAL NAMEPLATE SCHEDULE				
QTY.	TAG #	LETTERS/TAG	DESCRIPTION	PART #
1	N1	W/B	SUCTION > PRESSURE	50225266
1	N2	W/B	DISCHARGE > PRESSURE	50225266
1	N3	W/B	LOW ENGINE > OIL PRESSURE	50225266
1	N4	W/B	LOW COMPRESSOR > OIL PRESSURE	50225266
1	N5	W/B	ENGINE WATER > TEMPERATURE	50225266
1	N6	W/B	GAS DISCHARGE > TEMPERATURE	50225266
1	N7	W/B	RETURN OIL INLET > TEMPERATURE	50225266
1	N8	W/B	OIL FILTER DIFF > PRESSURE	50225266
1	N10	W/B	OIL COALESCING FILTER > DIFF. PRESSURE	50225266
1	N11	W/B	ENGINE > VACUUM	50225266
1	N12	R/W	EMERGENCY STOP	50225436
1	N15	W/B	PUSH TO CRANK	50225266
1	N16	W/B	PULL TO OPEN > SUCTION VALVE	50225266
1	N17	W/B	PULL TO CLOSE > BLOWDOWN VALVE	50225266
1	N18	W/B	PULL TO CLOSE > BYPASS VALVE	50225266
1	N19	W/B	SUCTION > PRESSURE	50225307
1	N20	W/B	DISCHARGE > PRESSURE	50225307
2	N21	W/B	ENGINE OIL > PRESSURE	50225307
2	N22	W/B	COMP OIL > PRESSURE	50225307
1	N23	W/B	LOW OIL > FILTER	50225307
2	N24	W/B	HIGH OIL > FILTER	50225307
1	N25	W/B	LOW OIL > COAL FILTER	50225307
1	N26	W/B	HIGH OIL > COAL FILTER	50225307
2	N27	W/B	ENGINE > VACUUM	50225307
1	N28	W/B	LINE > PRESSURE	50225266
1	N29	W/B	LINE > PRESSURE	50225307
1	N30	W/B	ENGINE SPEED > CONTROL	50225266
1	N31	W/B	BYPASS > VALVE	50225266
1	N32	W/B	FUEL > VALVE	50225307
1	N33	W/B	STARTER	50225307
1	N37	W/B	INSTRUMENT > SUPPLY	50225307
1	N38	W/B	INLET > VALVE	50225307
1	N39	W/B	VENT	50225307
1	N40	W/B	BUILDING AIR > TEMPERATURE	50225266
1	N41	W/B	SALES GAS > TEMPERATURE	50225266
1	N42	W/B	LARGE SERIAL NUMBER TAG	50225435
1	N43	W/B	ENGINE SPEED > CONTROL	50225307
1	N33A	W/B	STARTER VENT	50225307

ITEM NUMBERS CORRESPOND TO PANEL LEGEND ON DRAWING NO. 50-30-3740

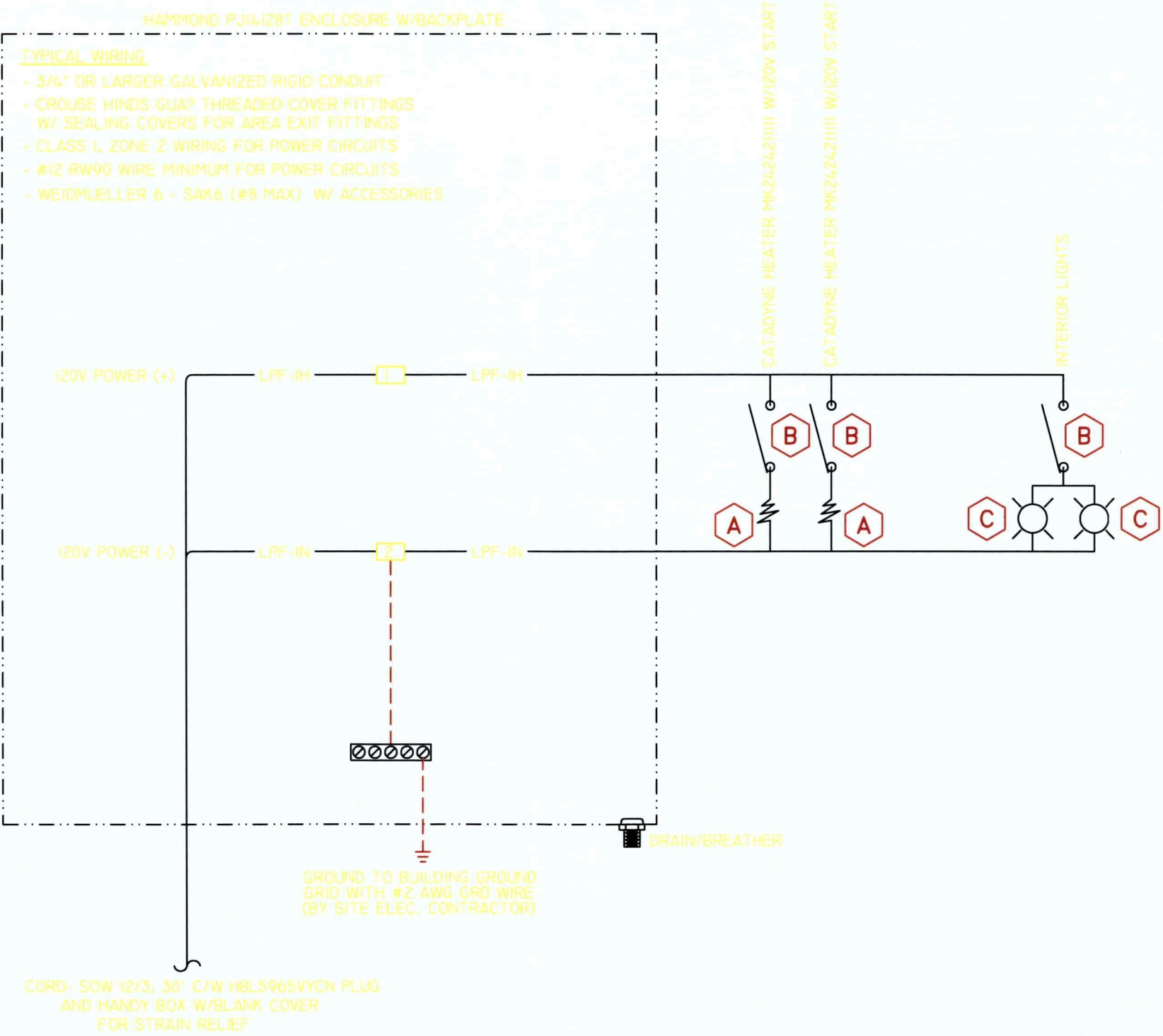
				DRAWN BY LINDA	 CONTROL SYSTEMS & SERVICES - ROSENBERG, TX FOR WATERFLOOD SERVICE & SALES STAND LAYOUT
				CHK'D BY	
				APP'D BY	
				DATE 10-03-02	
				SCALE 3/16	YOUR NO. _____ OUR NO. 50-30-2668 DWG. NO. 50-29-3740 REV. D
				SHEET 2 OF 2	
REV.	DESCRIPTION	DCN No.	DATE	CHK'D BY	
D	ADDED BULKHEAD "Y" AND NAMEPLATE N33A	05-H162	05-18-05		
C	NO CHANGES THIS SHEET	04-H169	05-11-04		
B	NO CHANGES THIS SHEET		10-30-01		
A	AS BUILT		10-21-02		

MATERIAL	FINISH PAINT TEXTURED RED	UNLESS OTHERWISE NOTED DIMENSIONS ARE IN INCHES .xx ±.030 ANGLES ±2° .xxx ±.010 125 FRACTIONS ±1/16
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BILL OF MATERIALS

ITEM	QTY.	DESCRIPTION	MANUFACTURER	PART#	NOTES
A	2	CATADYNE HEATER FOR NATURAL GAS W/120V START	CISCAN	MKII 24242HIII	1,3
B	3	XP SWITCHES SW W/EDS BOX	CROUSE HINDS	DSFS933	1,4
C	2	INCANDESCENT LIGHT W/PENDENT MOUNT & GUARD		EVA- 150W	1,4



- NOTES:
- 1. WIRED TO CLASS I, DIV.I SPECIFICATIONS
 - 2. WIRED TO CLASS I, DIV.II SPECIFICATIONS
 - 3. WSS SUPPLIED
 - 4. WSS ELECTRICAL SUBCONTRACTOR SUPPLIED

NOTE:

ALL CONDUIT IN SKID TO BE RUN A MINIMUM OF 5" UP OFF BOTTOM OF SUMP AREA

ISSUED FOR CONSTRUCTION
SEPTEMBER 20/2006

PER _____
CARMON R. LINDQUIST

CHECKED BY

PER _____

REV	DATE	REVISION DESCRIPTION
1		
2		
3		
4		



TITLE WATERFLOOD SERVICE & SALES LTD.
SSH ROTARY
FLOODED SCREW COMPRESSOR

PROJECT G3304NA/SSH
ELECTRICAL PRINT
JOB #1220

DESIGNED HARVEY KING	DATE 09/20/06	DRAWN CARMON LINDQUIST	DATE 09/20/06
APPROVED	DATE	CHECKED	DATE
SCALE NTS	COMPUTER FILE # 1220 ELECJB.DWG	SHEET 1 OF 1	REV 0
	DRAWING CONTROL # 1220ELECJB-1-1		

February 27, 2007

07C6525-CO-L-001
REV 0

Waterflood Service & Sales Ltd.
130 Perkins St, Estevan, Saskatchewan, S4A 0C3

Attention: Carmon R. Lindquist

Dear Carmon:

Re: Fugitive Emission Study – Flooded Screw Compressor Skid (1220)

As per your request Colt Engineering has completed a Fugitive Emission Study for the Screw Compressor Skid Module. The following is the detailed description for the method used, an explanation of the area classification and our recommendations regarding this particular Compressor Skid Module.

The purpose of this study, is to classify the interior of the enclosed Compressor Skid Module to a Class 1, Zone 2 classified location as per the Canadian Electrical Code and API Recommended Practice 505. This is accomplished by determining the minimum ventilation requirements ensuring that the concentration of vapor or gas is maintained below 25% of the lower flammable limit within the building interior. This is based on a reasonable estimate of normal fugitive emissions from hydrocarbon handling equipment, flanges, valves, threaded connection points, etc. within the building and determining the necessary ventilation louvers required for ventilation by "Natural Means".

For the purpose of this study all connections have been assumed as threaded connections to provide the worst case scenario.

As shown on the Area Classification Drawing (Dwg. D-1220-E-101), we have employed the Zone System of area classification for new installations, as outlined in Section 18 of the 2006 Canadian Electrical Code (Part 1). Due to the size of the building and the number of flanges, connections and doors along the outside wall; we have shown a 3 meter envelope around the building as a Class 1, Zone 2 classified area. All electrical equipment within this area must be CSA Approved and suitable for the Class 1, Zone 2 area classification.

To cover the ventilation required with the Compressor Skid, the following is required:

- Three (3) 14"X18" low wall louvers, maintaining a 50% minimum opening at all times when the compressor is running.
- One ridge vent 185"x 5", maintaining a 50% minimum opening at all times when the compressor is running.

- When the compressor is shutdown and the blow down valve has released the system gas pressure, and only after gas detection has been performed, louvers and ridge vent can be maintained minimum 10% open to allow the building to heat up. **Before starting the compressor, ridge vent and louvers must be opened to a minimum of 50%.**
- Gas detector to alarm on high LEL is normally recommended. As a minimum, Owner procedures must cover minimum requirements for personnel safety when at site.
- Procedures for detecting gas accumulation, building entry, operation and re-start of the unit are the main responsibility of the Owner and must be in place to assure personnel safety and prompt response in case of abnormal conditions.

This Fugitive Emissions Study is valid for Natural Gas Only with minimum 85% Methane, maximum 6% Ethane, maximum 6% Propane, No H₂S, No H₂, and the rest inert gases. Gas Composition to be verified by Owner before commissioning, in case of deviation from the parameters indicated above a review of the Fugitive Emission Study is required.

As indicated on the Area Classification Drawing and the attached document, we also recommend the following:

- Supply and installation of lamacoids at each of the ventilation louvers and ridge vent control locations. Labels shall be made as per the attached documents.
- All the electrical equipment and components inside the building and within the three meters Zone 2 envelope should be CSA Approved and suitable for the Class 1, Zone 2, Group IIA, Temp Code T1 area classification.

Please contact me at (403) 640-5997 if there are any questions or details required.

Yours truly,

COLT ENGINEERING CORPORATION



Assaad Sawma

CALCULATION COVER SHEET

CUSTOMER: WATERFLOOD SERVICE AND SALES JOB NO.: 07C6525
PROJECT: SCREW COMPRESSOR PKG PROJECT FILE NO.: E-08-01
TYPE OF CALCULATION: FUGITIVE EMISSION CALCULATION 07C6525-CALC-E-01 REV. NO.: 0

PURPOSE/DESCRIPTION:

CALCULATE THE FUGITIVE EMISSIONS FOR THE COMPRESSOR BUILDING G3304NA-SSHBG PKG AND
CALCULATE THE REQUIRED NATURAL VENTILATION TO CLASSIFY THE BUILDING AS CLASS 1, ZONE 2

THIS CALCULATION IS BASED ON THE FOLLOWING INFORMATION

WATERFLOOD SERVICE P&ID PRINT, Dwg. 1220P&ID-1-1, REV 0 (Sept.20, 2006)
WATERFLOOD SERVICE OVERVIEW PRINT, Dwg. 1220OVERVIEW-1-1, REV 0 (Sept.20, 2006)
WATERFLOOD BUILDING PRINT, Dwg. 1220BUILDING-1-1, REV 0 (Sept. 20, 2006)

THE FOLLOWING INFORMATION TAKEN FROM PREVIOUS FUGITIVE EMISSION STUDIES DONE FOR WATER FLOOD

PRODUCT = NATURAL GAS, AVE MOLECULAR WT=16, MAX AMBIENT TEMP=104 F AND %LEL=5

THIS CALCULATION IS VALID FOR COMPRESSOR SKID 1220 ONLY

THIS FUGITIVE EMISSIONS STUDY IS VALID FOR SWEET NATURAL GAS ONLY WITH MINIMUM 85% METHANE
MAXIMUM 6% ETHANE, MAXIMUM 6% PROPANE, NO H2S AND THE REST INERT GASES.

GAS COMPOSITION TO BE VERIFIED BEFORE COMMISSIONING, IN CASE OF DEVIATION FROM THE
PARAMETERS INDICATED ABOVE A REVIEW OF THIS FUGITIVE EMISSIONS STUDY IS REQUIRED.



COMPUTER PROGRAMS AND/OR DESIGN MANUALS USED:

SEE SPREADSHEET ATTACHED

THIS REVISION HAS BEEN SUPERSEDED BY REVISION: ☐

REVISION NOTES:

colt engineering corporation
engineers/constructors

THIS REVISION PREPARED BY: Assaad Sawma  DATE: Feb. 27, 2007
THIS REVISION CHECKED BY: Sujit Das  DATE: Feb. 27, 2007
PRELIMINARY OR FINAL? FINAL

Fugitive Emission Calculation

(Per API #4615 (JANUARY 1995), Emission Factors for Oil and Gas Production Operations)

TABLE 8, API No.4615 1995, AVERAGE EMISSION FACTORS				
FACILITY TYPE	STYLE	QTY.	PREDICTION FACTOR (LBS/DAY)	TOTAL EMISSIONS (LBS/DAY)
1. ONSHORE LIGHT CRUDE	CONNECTIONS		0.00866	
	FLANGES		0.00407	
	OPEN-ENDED		0.0638	
	PUMPS		0.0168	
	VALVES		0.07	
	OTHERS		0.397	
	SUBTOTAL 1=			0
2. ONSHORE HEAVY CRUDE	CONNECTIONS		0.000422	
	FLANGES		0.00116	
	OPEN-ENDED		0.00818	
	PUMPS		0.0168	
	VALVES		0.000686	
	OTHERS		0.0037	
	SUBTOTAL 2 =			0
3. ONSHORE GAS PRODUCTION	CONNECTIONS	285	0.017	4.845
	FLANGES	69	0.00623	0.42987
	OPEN-ENDED	0	0.0363	0
	PUMPS	2	0.0103	0.0206
	VALVES	40	0.139	5.56
	OTHERS	9	0.486	4.374
	SUBTOTAL 3 =			15.22947
4. GAS PLANTS	CONNECTIONS		0.0145	
	FLANGES		0.0232	
	OPEN-ENDED		0.0546	
	PUMPS		0.609	
	VALVES		0.204	
	OTHERS		0.257	
	SUBTOTAL 4 =			0
5. OFFSHORE OIL & GAS	CONNECTIONS		0.0057	
	FLANGES		0.0104	
	OPEN-ENDED		0.0537	
	PUMPS		0.0103	
	VALVES		0.0272	
	OTHERS		0.367	
	SUBTOTAL 5 =			0
ADDITION OF ABOVE SUBTOTALS 1,2,3,4, 5 =				15.2295
E =				0.6346

Client: WATERFLOOD SERVICE
 Location: ALBERTA
 Project: FUGITIVE EMISSIONS STUDY
 Building: FLOOD SCREW COMPRESSOR
 Ref. P&ID: DWG. #1220-P&ID SHT 1 OF 1, REV 0

Job No.: 07C6525
 Original Date: _____
 Today's Date: 5-Mar-07 15:30
 By: A. Sawma
 Notes: _____

Building Dimensions:

Dimensions (ft.), L = 15.4
 W = 11
 Eave H = 8
 Peaked Roof Slope = 4 : 12
 VOL = 1,510 CU FT

Required Ventilation Calculations Per API RP 500 & RP 505:

Product: Natural Gas
 Average Molecular Wt.: 16
 Max. Ambient Temp.(F): 104
 %LEL: 5

Volume (temp. corrected), V = 359 * (460 + Ta) / (460 + 32) = 411.5 CU FT.

Leak Rate, G = (E * V) / (60 * Ave. mW) = 0.2720

Ventilation Rate, Qr = G / (25 %LEL * MIN %LEL) = 21.8 CU FT.

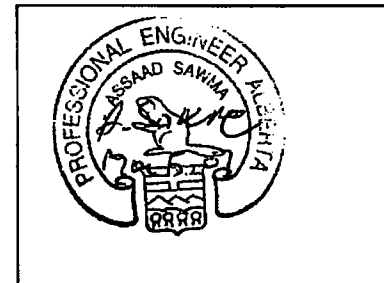
Safety factor of 4, RATE Q = 4 * Qr = 87.0 CFM.

Air Changes/ Hr:

N_{acph} = Q * 60 / BLDG VOLUME = 3.458 ACPH

Notes:

1. * "OTHERS" includes: some instruments, loading arms, pressure relief valves, stuffing boxes, compressor seals, dump lever arms, and vents.



E-08-01

Building Ventilation Area Calculation

Location: ALBERTA

Job No.: 07C8525

Building: FLOOD SCREW COMPRESSOR

Today's Date: 05-Mar-07

Air changes per hour:

- wind effect (2 kph, 0.55 m/s), through lower louver

- stack effect (Tab: Vent. - Stack Effect)

ACPH

Bldg. Vol.

1,510 ft³

4.74

4.74

Inputs for stack effect:

Calculated wind plus stack effect Total Ventilation Provided:

9.48

Ave. Vert. Upper-Lower Sep., H: 9

Fugitive emission calculation - Required Ventilation:

3.46

Inside Temp., TI: 20

CAN classify building Zone 2

Outside Temp., To: 18

For reference: Average time to reach 100% LEL with no ventilation: 9.25 Hrs

Lower Openings:**Low Wall Louvers:**

Length (in.) 18

Width (in.) 14

Quantity 3

Area (sq. in.) 756

% Min. Open 50 (3 louvers, all 50% open)

Min. Area (in²) 378**Low Exhaust Fan**

Diameter (in.)

Quantity

Area (sq. in.) 0

Windows Type 1:

Length (in.) 36

Width (in.) 36

Quantity 1

Area (sq. in.) 1296

% Area Open 0

Min. Area (in²) 0**Windows Type 2:**

Length (in.)

Width (in.)

Quantity 0

Area (sq. in.) 0

% Area Open 0

Min. Area (in²) 0**Man Door Gaps:**

Length (in.) 85.5

Width (in.) 78

Gap (in.) 0.05

Quantity 1

Area (sq. in.) 16.15

Equipment Door Gaps:

Length (in.)

Width (in.)

Gap (in.) 0.025

Quantity

Area (sq. in.) 0

Other Low Opening Gaps:

Length (in.) 0

Opening Gap (in.) 0

Quantity 0

Area (sq. in.) 0

(used for wind ventilation calculation)

Lower Total: 394

Upper Openings:**High Wall Louvers or Windows:**

Length (in.) 0

Width (in.) 0

Quantity 0

Area (sq. in.) 0

% Min. Open 50

Min. Area (in²) 0**High Exhaust Fan**

Diameter (in.)

Quantity

Area (sq. in.) 0

Ridge Vent

Length (in.) 169

Opening Width (in.) 5

Quantity 1

Area (sq. in.) 845

% Min. Open 50 (50% open)

Min. Area (in²) 422.5**Circular Roof Louvers:**

Diameter (in.)

Quantity

Area (sq. in.) 0

Other High Opening Gaps (upper door):

Length (in.)

Opening Gap (in.)

Quantity

Area (sq. in.) 0

Upper Total: 423

E-08-01

Natural Ventilation Calculation for Buildings

Based on Stack Effect

Reference: API RP 500 1997, Section 6.3.2 and Appendix A (Div.) and
API RP 505 1997, Section 6.6 and Appendix A (Zones)

Client: WATERFLOOD SERVICE
Location: ALBERTA
Project: FUGITIVE EMISSIONS STUDY
Building: FLOOD SCREW COMPRESSOR
P&ID No.: DWG. #1220-P&ID SHT 1 OF 1, REV 0

Job No.: 07C6525

Date: 00-Jan-00

Rev: Mar/5/07 15:47

By: A. Sawma

Notes: 0

0

Building Dimensions:

(Inputs from "Fug. Emission" and "Vent. Area Calcs." tabs.)

Length:	15.4 ft.	Upper Opening, A2:	423 in. ²
Width:	11 ft.	Lower Opening, A1:	394 in. ²
Eave Height:	8 ft.	Ave. Vert. Separation, H:	9 ft.
Roof Slope:	4 : 12		
Volume, V:	1510 ft ³	Inside Temp., Ti:	20 C
Volume:	43 m ³	Outside Temp., To:	18 C

Calculations:

(Based on Stack-Effect)

Actual Air Flow = (smallest vent x louver ratio coeff. / A) x 12:	4.74 air changes per hour
Minimum air flow from fugitive emission calculation:	3.46 air changes per hour

CAN be classified Zone 2 based on stack-effect only.

$$h = \frac{H}{1 + ((T_i + 273) / (T_o + 273))} = 4.48 \text{ ft.}$$

(*omitted A_1^2/A_2^2 term)

$$A = \frac{V}{1200 \times \sqrt{h \times (T_i - T_o) / (T_i + 273)}} \times 144 = 1036 \text{ in.}^2 \quad \text{For inlet and required for outlet.}$$

Definitions:

h = height above lower vent of equal air pressure on walls.

A = minimum size of the smallest louver to provide 12 air changes per hour, as per API RP 500 for adequate natural ventilation, without the need to provide a fugitive emission calculation.

E-08-01

Recommendations
To Provide Adequate Ventilation
To Classify Building to Class I, Zone 2

Client: WATERFLOOD SERVICE
Location: ALBERTA
Project: FUGITIVE EMISSIONS STUDY
Building: FLOOD SCREW COMPRESSOR
P&ID No.: DWG. #1220-P&ID SHT 1 OF 1, REV 0

Job No.: 07C6525

Date: 00-Jan-00

Rev: 05-Mar-07

By: A. Sawma

Notes: _____

Recommendations and Comments:

Building is classified as Class 1 Zone 2 based upon three (3) low wall louvers 14" x 18" and a Ridge vent 5" x 169".

Louvers must be a minimum of 50% open at all times when the compressor is running.
Ridge Vent must be a minimum of 50% open at all times when the compressor is running.

When the compressor is shutdown and the blowdown valve has released the system gas pressure, and only after gas detection has been performed, louvers and ridge vent can be maintained minimum 10% open to allow the building to heat up. **Before starting the compressor, ridge vent and louvers must be opened to a minimum of 50%.**

Gas detector to alarm on high LEL is normally recommended. As a minimum, Owner procedures must cover minimum requirements for personnel safety when at site.

Procedures for detecting gas accumulation, building entry, operation and re-start of the unit are the main responsibility of the Owner and must be in place to assure personal safety and prompt response in case of abnormal conditions.

These labels should be attached near each ventilation opening mechanisms.

FOR LOUVERS

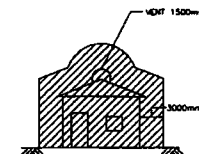
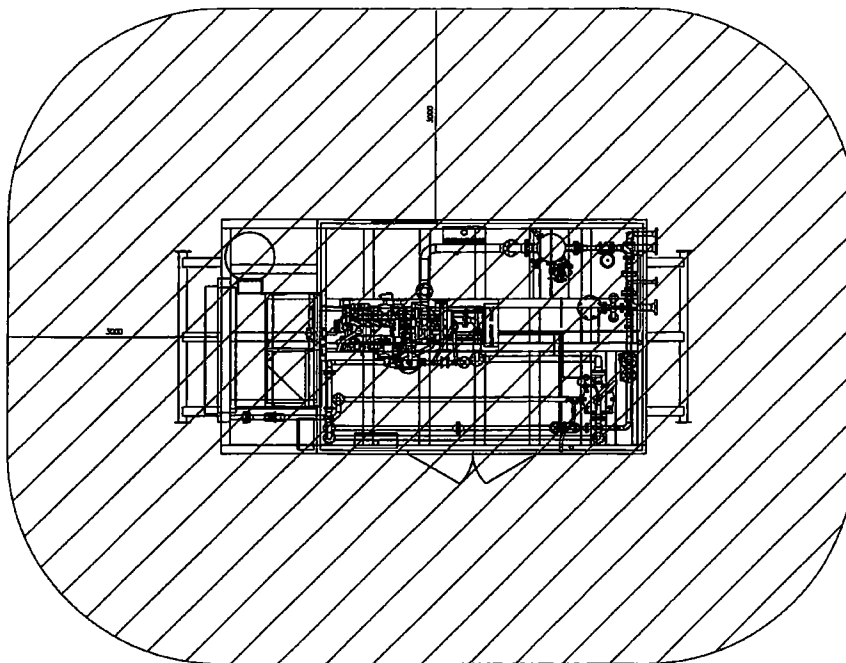
CAUTION

This building is classified as Class I, Zone 2 based on fugitive emission study and adequate natural ventilation. All three (3) louvers must be minimum 50% open at all times.

FOR RIDGE VENT

CAUTION

This building is classified as Class I, Zone 2 based on fugitive emission study and adequate natural ventilation. Ridge Vent must be minimum 50% open at all times.



CLASS 1, ZONE 2 BUILDING
PER FUGITIVE EMISSION STUDY

LEGEND

- CLASS 1 ZONE 0, GROUP 1A
- CLASS 1 ZONE 1, GROUP 1A
- CLASS 1 ZONE 2, GROUP 1A
- CLASS 1 ZONE 2, GROUP 1A FOR 1500mm ADEG GRADE (UNLESS OTHERWISE NOTED)
- NONCLASSIFIED

NOTES:

1. COMPRESSOR SKID VENDOR SHALL SUPPLY AND INSTALL UNIMOUNTED WITH RED LETTERS ON A WHITE BACKGROUND WHICH READS AS FOLLOWS:
FOR EACH LOUVER
CAUTION
THIS BUILDING IS CLASSIFIED AS CLASS 1, ZONE 2 BASED ON FUGITIVE EMISSION STUDY AND ADEQUATE VENTILATION. LOUVERS MUST BE OPEN A MINIMUM OF 50% AT ALL TIMES WITH GAS GROUP 1A AND TAP CODE 11.
FOR RIDGE VENT
CAUTION
THIS BUILDING IS CLASSIFIED AS CLASS 1, ZONE 2 BASED ON FUGITIVE EMISSION STUDY AND ADEQUATE VENTILATION. RIDGE VENT MUST BE OPEN A MINIMUM OF 50% AT ALL TIMES.
ONE (1) SIGN TO BE LOCATED AT THE RIDGE VENT OPERATOR CHAMBER AND ONE (1) SIGN TO BE LOCATED AT EACH LOUVER.
2. ALL ELECTRICAL EQUIPMENT INSIDE THE BUILDING AND WITHIN THE THREE METER ZONE 2 ENVELOPE MUST BE CSA APPROVED AND SUITABLE FOR CLASS 1, ZONE 2 AREA CLASSIFICATION.
3. FUGITIVE EMISSION AND NATURAL VENTILATION CALCULATIONS FOR BUILDING ARE BASED ON API RECOMMENDED PRACTICE 800, NOV. 1987, SECTION 8.0 AND APPENDIX 'A' (ZONES).
4. FUGITIVE EMISSION CALCULATION IS FOR SKID 1220 SCREW ROTARY COMPRESSOR PACKAGE ONLY.
5. THE AREA CLASSIFICATION SHOWN IN THIS DRAWING IS VALID FOR A STAND ALONE UNIT ONLY. WHEN THIS UNIT IS INSTALLED IN A FACILITY INCLUDING MULTIPLE HAZARDOUS AREAS A DETAILED AND INTEGRATED AREA CLASSIFICATION DRAWING MUST BE PREPARED TO ASSURE THE CLASS 1, ZONE 2 AREA IS MAINTAINED.

DWG. NO.	REFERENCE DRAWINGS	REV	REVISIONS	DATE (MM/DD/YY)	BY	CHK'D	APP'D	CLIENT APP'D
		0	ISSUED FOR CONSTRUCTION	21/01/07	OK	AP	SD	

DESIGNER AND PERMIT STAMPS

PERMIT TO PRACTICE
GULF DRILLING CORPORATION
Signature: *[Signature]*
Date: 5/1/07
PERMIT NUMBER: P 725
(in accordance with Professional Engineers' Code and Regulations of Alberta)

DESIGNED BY: <i>[Signature]</i> CHECKED BY: <i>[Signature]</i> PROJECT EN: <i>[Signature]</i> MECH. EN: <i>[Signature]</i> STRUCT. EN: <i>[Signature]</i> ELEC. EN: <i>[Signature]</i> DATE: 05/03/07	<p>Coit Engineering Corporation</p> <p>CLIENT: WATERFLOOD SERVICES & SALES</p> <p>PROJECT: 1220 FLOODED SCREW COMPRESSOR</p> <p>AREA CLASSIFICATION</p> <p>200 NO. 07C5525 SCALE 1:30 DWG. NO. D-1220-E-101 SHEET 1 OF 1</p>
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