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JACOBS P.O. 58-BK6860-HH000583
ITEM # 67-5095
RL2 REACTOR CIRCULATION
PUMP
SAP # 10533692

REVISION	LINE NUMBER	JACOBS ENGINEERING Engineers and Constructors	PROJECT NO. 58-BK65-40 P.O. NO. HH000583 INQUIRY NO. 58-BK6560-010001 MADE BY PW/DED REVISION 0	ITEM NO. 67-5095 DATE 2/25/04 APPROVED DATE 9/22/04
CENTRIFUGAL PUMP (API-610a) DATA SHEET			SHEET 1 OF 1	
PLANT: CFCHEM			PROJECT: PSCP RESTRUCTURING	
1 APPLICABLE TO: (proposal, purchase, as built) <u>Purchase</u>			UNIT NO. GPH	
2 CLIENT: <u>CHEVRON PHILLIPS</u>			SERVICE <u>RL2 CIRCULATION PUMP</u>	
3 LOCATION: <u>PASADENA, TEXAS</u>			TYPE <u>AXIAL FLOW ELBOW</u> NO. STAGES <u>1</u>	
4 NO. REQUIRED <u>1</u> PUMP SIZE <u>16" X 16"</u>			MODEL <u>SERIES 9500</u> SERIAL NO. <u></u>	
5 MANUFACTURER: <u>LAWRENCE PUMPS, INC.</u>			NOTES: INFORMATION BELOW TO BE COMPLETED: <input type="radio"/> BY PURCHASER <input type="radio"/> BY MANUFACTURER <input checked="" type="radio"/> MANUFACTURER OR PURCHASER	
<input checked="" type="radio"/> GENERAL				
8 PUMP LINE UP (series, parzel) <u></u>			NO. MOTOR DRIVEN <u>1</u> NO. TURBINE DRIVEN <u></u>	
9 DRIVE TYPE <u>Induction Motor</u>			PUMP ITEM NO. <u>67-5095</u> TURBINE ITEM NO. <u></u>	
10 GEAR ITEM NO. <u></u>			MOTOR ITEM NO. <u>30-5095</u> TURBINE ITEM NO. <u></u>	
11 GEAR PROVIDED BY <u></u>			MOTOR PROVIDED BY <u>SIEMENS</u> TURBINE PROVIDED BY <u></u>	
12 GEAR MOUNTED BY <u></u>			MOTOR MOUNTED BY <u>PUMP VENDOR</u> TURBINE MOUNTED BY <u></u>	
13 GEAR DATA SHT. NO. <u></u>			MOTOR DATA SHT. NO. <u>30-5095</u> TURBINE DATA SHT. NO. <u></u>	
OPERATING CONDITIONS				
15 <input type="radio"/> CAPACITY, NORMAL <u>14500</u> USgal/min RATED <u>14500</u> USgal/min				
16 OTHER <u></u>				
17 <input type="radio"/> SUCTION PRESSURE MAX <u>855</u> RATED <u>500</u> psig				
18 <input type="radio"/> DISCHARGE PRESSURE <u>514</u> psig				
19 <input type="radio"/> DIFFERENTIAL PRESSURE <u>14</u> psi				
20 <input type="radio"/> DIFFERENTIAL HEAD <u>59</u> ft NPSHA <u>600</u> ft				
21 <input type="radio"/> PROCESS VARIATIONS <u></u>				
22 <input type="radio"/> STARTING CONDITIONS <u></u>				
23 SERVICE (cont., intermittent) <u>Continuous</u>				
24 <input type="radio"/> PARALLEL OPERATION REQUIRED (yes, no) <u>No</u>				
SITE AND UTILITY DATA				
26 LOCATION				
27 INDOORS (yes, no) <u>No</u> HEATED (yes, no) <u>No</u>				
28 COVERED (yes, no) <u>No</u> PARTIAL SIDES (yes, no) <u>No</u>				
29 ELEVATION <u>Grade</u>				
30 <input type="radio"/> ELECTRICAL AREA CLASSIFICATION				
31 CL <u>1</u> GR <u>C/D</u> DIV <u>2</u>				
32 <input type="radio"/> ENVIRONMENT REQUIREMENTS <u></u>				
33 SITE DATA				
34 <input type="radio"/> ALTITUDE <u>36</u> ft <input type="radio"/> BAROMETRIC <u>14.7</u> psia				
35 <input type="radio"/> RANGE OF AMBIENT TEMPS: MIN/MAX <u>20</u> °F / <u>105</u> °F				
36 <input type="radio"/> RELATIVE HUMIDITY <u>0</u>				
37 UNUSUAL CONDITIONS <u></u>				
38 <input type="radio"/> OTHER <u></u>				
39 <input type="radio"/> UTILITY CONDITIONS:				
40 STEAM (PRESS./TEMP) DRIVERS HEATING				
41 MIN <u></u> psia / <u></u> °F <u></u> psia / <u></u> °F				
42 MAX <u></u> psia / <u></u> °F <u></u> psia / <u></u> °F				
43 ELECTRICITY DRIVERS HEATING CONTROL SHUTDOWN				
44 VOLTAGE <u>4000</u> V <u></u> V <u>110</u> V <u></u> V				
45 HERTZ <u>60</u> Hz <u></u> Hz <u>60</u> Hz <u></u> Hz				
46 PHASE <u>3</u> <u></u> <u>1</u> <u></u>				
47 COOLING WATER				
48 INLET TEMP <u>86</u> °F MAX. RETURN TEMP <u>101</u> °F				
49 NORMAL PRESS. <u>50</u> psig DESIGN PRESS. <u>100</u> psig				
50 MIN. RETURN TEMP <u></u> °F MAX. ALLOW DP <u>20</u> psi				
51 REMARKS: 1) INTERNAL DIAMETER OF THE PUMP AT THE SUCTION AND DISCHARGE FLANGES MUST BE 14.688 INCHES TO MATCH LOOP REACTOR I.D.				
52 2) ALL INTERNAL PUMP SURFACES IN CONTACT WITH PROCESS FLUID SHALL BE POLISHED TO MAXIMUM ROUGHNESS OF 2 MICRONS.				
53 3) NO MATERIALS OF ANY KIND CONTAINING COPPER ARE ALLOWED IN CONTACT WITH THE PROCESS FLUID.				
54 4) MINIMUM ACCEPTABLE PUMP CASING DESIGN CONDITIONS ARE 900 PSIG @ 302 AND -50 DEGREES F.				
55 5) SEAL OIL PRESSURIZATION UNIT SHALL BE PURCHASED BY OTHERS; SEALS AND SEAL POTS WILL BE FURNISHED FREE ISSUE TO LPL.				
56 6) MDMT IN PROPYLENE SERVICE SHALL BE MINUS 50 DEGREES F.				
57				

SITE AND UTILITY DATA (CONT'D)		
WATER SOURCE <u>COOLING TOWER</u>		
CHLORINE CONCENTRATION <u></u>		
INSTRUMENT AIR MAX/MIN. PRESSURE <u>135</u> / <u>80</u> psig		
LIQUID		
<input type="radio"/> TYPE OR NAME OF LIQUID <u>PP SLURRY IN PROPYLENE</u>		
<input type="radio"/> PUMPING TEMPERATURE		
NORMAL <u>140</u> MAX <u>158</u> MIN. <u>90</u> °F		
<input type="radio"/> VAPOR PRESSURE <u>369</u> psia		
<input type="radio"/> RELATIVE DENSITY (SPECIFIC GRAVITY)		
NORMAL <u>0.55</u> MAX <u>0.55</u> MIN. <u>0.44</u>		
<input type="radio"/> SPECIFIC HEAT <u>0.7</u> BTU/lb °F		
<input type="radio"/> VISCOSITY <u>0.08</u> cP @ <u>140</u> °F		
<input type="radio"/> MAX VISCOSITY <u>0.15</u> cP		
<input type="radio"/> CORROSIVE/EROSIVE AGENT <u></u>		
<input type="radio"/> CHLORIDE CONCENTRATION <u></u> fract		
<input type="radio"/> H2S CONCENTRATION <u></u> fract		
(flammability, lethal service, toxicity) <u>FLAMMABLE</u> / <u></u>		
<input type="radio"/> OTHER <u>35 WT% SOLIDS; 575 MICRON AVG. PARTICLE SIZE</u>		
PERFORMANCE		
<input type="checkbox"/> AS-BUILT CURVE NO. <u>T4990</u> <input type="checkbox"/> RPM <u>1786</u> rpm		
<input type="checkbox"/> IMPELLER DIA: RATED <u>14.61</u> MAX <u>14.61</u> MIN. <u>14.61</u> in		
<input type="checkbox"/> RATED POWER <u>208</u> hp (BPH) EFFICIENCY <u>64</u> %		
<input type="checkbox"/> MINIMUM CONTINUOUS FLOW		
THERMAL STABLE <u>11,600</u> USgal/min		
<input type="checkbox"/> PREFERRED OPERATING REGION <u>13,000</u> TO <u>19,800</u> USgal/min		
<input type="checkbox"/> ALLOWABLE OPERATING REGION <u>11,600</u> TO <u>21,600</u> USgal/min		
<input type="checkbox"/> MAX. HEAD @ RATED IMPELLER <u>72</u> ft		
<input type="checkbox"/> MAX. POWER @ RATED IMPELLER <u>208</u> hp		
<input type="checkbox"/> NPSHR AT RATED CAPACITY <u>115</u> ft		
<input checked="" type="checkbox"/> SUCTION SPECIFIC SPEED <u>7200</u>		
<input type="checkbox"/> MAX. SOUND PRESS. LEVEL RECD (dB) <u>85</u> dBA @ 3 FEET		
<input type="checkbox"/> EST. MAX SOUND PRESS. LEVEL (dB) <u></u>		
* PUMP IMPELLER PRODUCES 64 FT. TDH @ 1786 RPM; RATED POWER IS BASED ON 14,500 GPM @ 64 FT. TDH.		

JACOBS ENGINEERING GROUP INC - CENTRAL REGION		
PROJECT NO. 58-BK65-40	P.O. NO. 583	SERIAL NO. 67-5095
SIGNATURE DATE <u>[Signature]</u> 3/13/06	ITEM NO. 67-5095	SUSPENSE DATE 2/7/2006
IF NO COMMENTS, RE-SUBMIT, PROCEED WITH FABRICATION		
IF C. UNACCEPTABLE - DO NOT PROCEED WITH FABRICATION		
IF R. FOR INFORMATION ONLY		
Review of this drawing by Jacobs Engineering Group does not relieve the supplier of his responsibility to supply the materials in accordance with the procurement documents.		

VDRNA 1003

REVISION



CENTRIFUGAL PUMP (API-610b)

DATA SHEET

PROJECT NO. 28-BK65-40

ITEM NO. 97-5295

REVISION 0

DATE 9/22/04

SHEET 2 OF 3

PLANT: CPCHEM

PROJECT: PSPC RESTRUCTURING

CONSTRUCTION

2 APPLICABLE STANDARD API 610 8TH EDITION

3 API 610 8TH EDITION

4 OTHER

5 PUMP TYPE (1.1.2) AXIAL FLOW ELBOW

6 OH2	BB1	VS1	VS8
7 OH3	BB2	VS2	VS7
8 OH5	BB3	VS3	OTHER
9	BB4	VS4	
10	BB5	VS5	

11 ☐ NOZZLE CONNECTIONS (2.3.2)

	SIZE	FLANGE RATING	FACING	POSITION
12 SUCTION	16	600	Raised face	HORIZONTAL
13 DISCHARGE	16	600	Raised face	VERTICAL
14 BALANCE DRUM				

15 PRESSURE CASING CONNECTIONS (2.3.3)

	NO.	SIZE (NPS)	TYPE
16 <input type="checkbox"/> DRAIN	NONE		
17 <input type="checkbox"/> VENT	NONE		
18 <input type="checkbox"/> PRESSURE GAUGE	NONE		
19 <input type="checkbox"/> TEMP. GAUGE	NONE		
20 <input type="checkbox"/> WARM-UP	NONE		
21 <input type="checkbox"/> BALANCE / LEAK-OFF	NONE		
22 <input type="checkbox"/> CYLINDRICAL THREADS REQUIRED (2.3.3) (yes, no)			

23 CASING MOUNTING Centreline

24 (CENTERLINE, NEAR CENTERLINE, IN-LINE) (SEPARATE SHEET FOR VERTICALS)

25 ☐ FOOT

26 ☐ SEPARATE MOUNTING PLATE

27 CASING SPLIT (axial, radial)

28 CASING TYPE

29 ☐ (single volute, multiple volute, diffuser)

30 ☒ (overhung, between bearings, barrel) Overhung

31 CASE PRESSURE RATING

32 ☐ MAX. ALLOWABLE WORKING PRESSURE 900 PSIG

33 ☐ HYDROTEST PRESSURE 1375 PSIG

34 ☐ SUCTION PRESS. REGIONS MUST BE DESIGNED FOR MAWP (yes, no) Yes

35 ROTATION (VIEWED FROM COUPLING END)

36 (CW, CCW) Counter Clockwise

37 ☐ IMPELLERS INDIVIDUALLY SECURED (yes, no) Yes

38 REMARKS:

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CONSTRUCTION (CONT'D)

- ☐ SHAFT DIAMETER BETWEEN BEARINGS 54.5 in
- ☐ SPAN BETWEEN BEARING CENTERS 125 in
- ☐ SPAN BETWEEN BEARING AND IMPELLER 125 in

REMARKS L3/D4 SHAFT STIFFNESS RATIO SHALL BE SHOWN IN THE BID.
BID SHALL ALSO SHOW CALCULATED SHAFT DEFLECTION AT STARTUP AND AT FULL PROCESS LOAD.

COUPLINGS

- ☐ MAKE THOMAS
- ☒ MODEL 71 (4W/N BALANCE)
- ☐ RATING (HP/100 RPM) 21.3
- ☐ LUBRICATION Non-Lube
- ☐ LIMITED END FLOAT REQUIRED Yes
- ☒ SPACER LENGTH 24 in
- ☒ SERVICE FACTOR 1.15 X MTR.
- ☐ DRIVER HALF COUPLING MOUNTED BY (pump mtr, driver mtr, purchaser) PUMP MTR.

☐ APPLICABLE STANDARD

BASEPLATES

- ☐ API BASEPLATE NUMBER
- ☐ NON-GROUT CONSTRUCTION (yes, no) Yes

REMARKS BASEPLATE SHALL BE ADJUSTABLE SPRING MOUNTED TYPE.
SPRINGS, ENCLOSURES, ADJUSTERS, ETC., SHALL BE SUPPLIED BY THE PUMP VENDOR.

MATERIAL OF CONSTRUCTION

- ☐ APPENDIX H CLASS A-7
- ☐ MIN. DESIGN METAL TEMPERATURE -50 F
- ☐ BARREL/CASE 304SS IMPELLER ALUMINUM
- ☐ CASE/IMPELLER WEAR RINGS NONE
- ☐ SHAFT 4340 STEEL Q & T
- ☐ DIFFUSERS
- ☐ COUPLING SPACER/HUBS CARBON STEEL
- ☐ COUPLING DIAPHRAGMS (DISKS) STAINLESS STEEL

REMARKS IMPELLER (PROPELLER) MATERIAL IS ASTM B721 GR. 6061-T6

BEARINGS AND LUBRICATION

- BEARING (TYPE / NUMBER)
- ☐ RADIAL BALL (IN SEAL CART.) / 1212
- ☐ THRUST DOUBLE ROW BALL / 2 X 7220
- ☐ REVIEW AND APPROVE THRUST BEARING SIZE (yes, no) Yes

LUBRICATION

- ☒ TYPE Flood
- ☐ CONSTANT LEVEL OILER PREFERENCE (SEE REMARKS) YES
- ☐ PRESSURE LUBE SYSTEM OFF SKID SEAL OIL UNIT LUBES RADIAL
- ☒ OIL VISC. ISO GRADE ISO VG68

REMARKS: BEARING HOUSING SHALL BE CARBON STEEL (NOT CAST OR DUCTILE IRON) AND SHALL BE FITTED WITH INPRO LABYRINTH TYPE OIL SEALS, A TRICO OPTIMATIC CONSTANT LEVEL OILER WITH VIEW PORT AND BEARING HOUSING VENT BREATHER. LUBRICATION SHALL BE FLOOD TYPE. ROLLING ELEMENT RADIAL AND THRUST BEARINGS SHALL HAVE A MINIMUM L-10 LIFE OF 60,000 HOURS PER ISO 281.

REVISION



CENTRIFUGAL PUMP (API-610c)

DATA SHEET

PROJECT NO. 33-BX65-40 ITEM NO. 67-5095
REVISION 0 DATE 9/22/04

SHEET 2 OF 2

PLANT: CFCHEM PROJECT: PSCP RESTRUCTURING

1 BEARINGS AND LUBRICATION (CONT)
2 ☒ OIL HEATER REQ'D (yes, no) TYPE (electric, steam)
3 ☐ OIL PRESS. TO BE GREATER THAN COOLANT PRESS. (yes, no)
4 REMARKS HEAT GAIN BY LUBRICANT IN THE BEARING HOUSING
5 SHALL BE FURNISHED AS A VENDOR DATA SUBMITTAL

MECHANICAL SEAL OR PACKING

8 SEAL DATA:
9 ☐ SEE ATTACHED API-682 DATA SHEET (yes, no) No
10 ☐ NON-API 682 SEAL (yes, no) Yes
11 ☐ APPENDIX H SEAL CODE BDTFX / BTTFX
12 ☐ SEAL MANUFACTURER JOHN CRANE ONLY
13 ☒ SIZE AND TYPE 3.000 / 3.625 / 3.375 / 4.500 P3B1
14 ☐ MANUFACTURER CODE
15 SEAL CHAMBER DATA:
16 ☐ TEMPERATURE °F
17 ☐ PRESSURE psig
18 ☐ FLOW lb/h
19 ☐ SEAL CHAMBER SIZE
20 ☐ TOTAL LENGTH ft ☐ CLEAR LENGTH ft
21 SEAL CONSTRUCTION:
22 ☐ SLEEVE MATERIAL 316 SS
23 ☐ GLAND MATERIAL 316 SS
24 ☐ AUX. SEAL DEVICE SEGMENTED CARBON THROTTLE BUSHING
25 ☒ JACKET REQUIRED (yes, no) No

26 GLAND TAPS:
27 ☒ FLUSH (F) Yes ☐ DRAIN (D) Yes ☐ BARRIER/BUFF (B) Yes
28 ☐ QUENCH (Q) Yes ☐ COOLING (C) ☐ LUBRICATION (G)
29 ☒ HEATING (H) ☐ LEAKAGE ☐ PUMPED FLUID (P)
30 ☐ BALANCE FLUID (E) ☐ EXTERNAL FLUID INJECTION (X)

SEAL FLUIDS REQUIREMENT AND AVAILABLE FLUSH LIQUID:

32 NOTE: IF FLUSH LIQUID IS PUMPAGE LIQUID (AS IN FLUSH PIPING

33 PLANS 11 TO 41), FOLLOWING FLUSH LIQUID DATA IS NOT REQ'D

34 ☐ SUPPLY TEMPERATURE, MAX / MIN 95 °F / 40 °F

35 ☐ RELATIVE DENSITY (SPEC GRAVITY) 0.49 @ 95 °F

36 ☐ NAME OF FLUID CLEAN PROPYLENE

37 ☐ SPECIFIC HEAT 0.67 BTU/lb °F

38 ☐ VAPOR PRESSURE 214 psia

39 ☐ HAZARDOUS ☐ FLAMMABLE Yes

40 ☐ FLOW RATE MAX / MIN 1750 lb/h / 1750 lb/h

41 ☐ PRESSURE REQUIRED MAX / MIN Pump Discharge + 25 psig

42 ☐ TEMPERATURE REQUIRED MAX / MIN 95 °F / 40 °F

43 BARRIERS/BUFFER FLUID:

44 ☐ SUPPLY TEMPERATURE MAX / MIN °F / °F

45 ☐ RELATIVE DENSITY (SPEC GRAVITY) @ °F

46 ☐ NAME OF FLUID ROYAL PURPLE 910 OR OTHER COMPATIBLE FLUID

47 REMARKS: 1) SEAL FACES SHALL ALL BE TUNGSTEN CARBIDE TO SILICON CARBIDE. THROAT BUSHING SHALL BE CARBON FILLED TFE.

48 2) THE OPERATING SET OF SEALS AND THE PRIMARY SEAL POT AND SAFETY SEAL POT WITH THEIR RESPECTIVE INSTRUMENTS, DRAIN

49 AND VENT PIPING SHALL BE PROVIDED FREE ISSUE TO THE PUMP VENDOR AND MOUNTED ON THE PUMP SKID. THE SEAL OIL

50 PRESSURIZATION (PISTON POT) SKID (TAG NO. 67-5097) SHALL BE PURCHASED BY JACOBS AND SENT DIRECTLY TO THE JOBSITE. THE

51 SPARE SEAL WILL ALSO BE FURNISHED FREE ISSUE TO THE PUMP VENDOR TO USE AS NEEDED OR TO SEND TO THE JOBSITE WITH THE

52 PUMP.

53 3) PIPING BETWEEN THE "P-102L OIL PRESSURE UNIT" AND THE CIRC. PUMP SKID SHALL BE BY OTHERS.

54 4) SEAL POTS AND PISTON POTS SHALL BE ASME CODE, STAMPED PRESSURE VESSELS OF 316 SS WITH ALL FLANGED NOZZLES.

55 5) THE CIRCULATION PUMP VENDOR SHALL SUPPLY ONLY A 316SS BUTTWELDED FLANGED CONNECTION FOR THE PLAN 32 CLEAN

56 PROPYLENE FLUSH TO THE SEAL CAVITY AND THROAT BUSHING. OTHERS WILL PROVIDE THE PLAN 32 AND ITS INSTRUMENTS.

57 6) TRANSMITTERS ARE REQUIRED IN LIEU OF SWITCHES WHEREVER FEASIBLE. A CABLE TRANSDUCER SHALL BE SUPPLIED TO ENABLE R-

MECHANICAL SEAL OR PACKING (CONT)

☐ VAPOR PRESSURE psia @ °F
☐ LIQUID
☐ FLOW RATE MAX / MIN 835 lb/h / 410 lb/h
☐ PRESSURE REQUIRED MAX / MIN Pump Discharge + 50 psig
☒ TEMPERATURE REQUIRED MAX / MIN °F / °F

QUENCH FLUID:

☐ NAME OF FLUID
☐ FLOW RATE lb/h

SEAL FLUSH PIPING:

☐ SEAL FLUSH PIPING PLAN 32 AND 53 MODIFIED
☐ TYPE (tubing, pipe) Pipe
☐ MATERIAL 316 SS ALL BUTTWELDED/FLGD
☐ AUXILIARY FLUSH PLAN 52 (SAFETY SEAL)
☐ TYPE (tubing, pipe) Pipe
☐ MATERIAL 316SS ALL BUTTWELDED/FLGD
☐ PIPING ASSEMBLY: Flanged and Buttwelded only
(threaded, unions, socket welded, flanged, tube type fittings)

☒ PRESSURE SWITCH (PLAN 52/53) TRANSMITTER
☐ PRESSURE GAUGE (PLAN 52/53) YES
☒ LEVEL SWITCH (PLAN 52/53) TRANSMITTER
☐ LEVEL GAUGE (PLAN 52/53) YES
☐ TEMP INDICATOR (PLANS 21, 22, 23, 32, 41) BY OTHERS
☐ HEAT EXCHANGER (PLAN 52/53) IN SEAL POTS

REMARKS TRANSMITTERS SHALL BE HONEYWELL SMART ST3000

(ALL TEMP FOR TEMPERATURE ELEMENTS) SERIES 24 VOLT

DC. INCLUDE CAUSE AND EFFECT CHART FOR ALARM/SHUT

PACKING DATA (APPENDIX G)

MANUFACTURER

TYPE

SIZE NO. OF RINGS

☐ PACKING INJECTION REQUIRED (yes, no)

☐ FLOW lb/h @ °F

☐ LANTERN RING (yes, no)

STEAM AND COOLING WATER PIPING

☐ COOLING WATER PIPING PLAN

☐ COOLING WATER REQUIREMENTS

SEAL JACKET, BRG HSG FLOW @ PRESS USgal/min psig

SEAL HEAT EXCHANGER FLOW @ PRESS USgal/min psig

QUENCH USgal/min psig

TOTAL COOLING WATER VOL FLOW USgal/min

☐ STEAM PIPING (tubing, pipe)

REMARKS:

REVISION



CENTRIFUGAL PUMP (API-610d)

DATA SHEET

PROJECT NO. 58-8K65-40 ITEM NO. 67-5025
REVISION 0 DATE 9/22/04

SHEET 4 OF 5

PLANT: OCEM

PROJECT: PSC RESTRUCTURING

1 INSTRUMENTATION

2 VIBRATION (NONCONTACTING API 670, TRANSDUCER, PROVISION FOR MOUNTING ONLY)

3 ☐ TRANSducers, CABLE AND JUNCTION BOX AS NOTED BELOW.

4 ☐ PROVISION FOR MOUNTING ONLY (YES, NO) No

5 ☐ FLAT SURFACE REQD (YES, NO) Yes

6 ☐ SEE ATTACHED API 670 DATA SHEET (YES, NO) No

7 ☐ MONITORS AND CABLES, accelerometers (YES, NO) Yes

8 REMARKS A TOTAL OF 4 BENTLEY NEVADA ACCELEROMETERS SHALL BE

9 PROVIDED AND MOUNTED BY THE PUMP VENDOR AND WIRED

10 BY THE VENDOR TO AN ON-SKID NEMA 4X SS JUNCTION BOX.

11 TEMPERATURE AND PRESSURE: (RADIAL/THRUST BRG METAL TEMP)

12 ☐ YES, RTDs FOR THRUST BEARING, WIRING TO NEMA 4X SS JUNC. B.

13 ☐ PROVISION FOR INSTRUMENTS ONLY (YES, NO) No

14 ☐ SEE ATTACHED API-670 DATA SHEET (YES, NO) No

15 ☐ TEMP GAUGES (WITH THERMOWELLS) (YES, NO) No

16 OTHER TEMPERATURE TRANSMITTER (RTD), SS THERMOWELLS

17 ☐ PRESSURE GAUGE TYPE

18 LOCATION

19 REMARKS BEARING HOUSING TEMPERATURE INSTRUMENTS REQUIRED

20 BY CIRCULATION PUMP VENDOR AS NOTED.

21

22 SPARE PARTS

23 ☐ START-UP QUOTE ☐ NORMAL MAINTENANCE

24 ☐ SPECIFY 2-YEAR RECOMMENDED SPARE PARTS TO BE QUOTED IN THE

25 PUMP BID.

26

27 MOTOR DRIVE

28 ☒ MANUFACTURER SIEMENS

29 ☐ POWER, RPM 250 hp 1800 rpm

30 ☒ ORIENTATION (HOR/VER) Horizontal

31 ☐ FRAME 50757

32 ☒ SERVICE FACTOR 1.0

33 ☒ VOLTS/PHASE/HERTZ 4000 V 3 60 Hz

34 ☐ TYPE GENERAL PURPOSE

35 ☒ ENCLOSURE TEFC

36 ☐ MINIMUM STARTING VOLTAGE V

37 ☐ TEMPERATURE RISE 176 °F

38 ☒ FULL LOAD AMPS 34.3 A

39 ☒ LOCKED ROTOR AMPS 205.7

40 ☒ INSULATION F-VPI

41 ☒ STARTING METHOD

42 ☒ LUBE OIL High Quality Turbine Type, V660

43 ☐ VERTICAL THRUST CAPACITY lb

44 UP lb DOWN lb

45 BEARINGS (TYPE / NUMBER)

46 ☐ RADIAL HYDRODYNAMIC /

47 ☐ THRUST /

48

49 REMARKS:

50

51

52

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54

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56

REMARKS

REMARKS

REMARKS

REMARKS

SURFACE PREPARATION AND PAINT

☐ MANUFACTURER'S STANDARD

☐ OTHER (SEE BELOW) SEE PAINT STDS IN INQUIRY

PUMP

☐ PUMP SURFACE PREPARATION SYSTEM 3.3

☐ PRIMER

☐ FINISH COAT CHEVRON SYSTEM 3.3

BASEPLATE

☐ BASEPLATE SURFACE PREPARATION SYSTEM 3.1

☐ PRIMER CHEVRON SYSTEM 3.1

☐ FINISH COAT SYSTEM 3.1, EXCEPT PRIMER ONLY ON BOTTOM

SHIPMENT

☐ Domestic

(DOMESTIC, EXPORT, EXPORT BOXING REQUIRED, OUTDOOR STORAGE)

SPARE ROTOR ASSEMBLY PACKAGED FOR (HORIZONTAL/VERTICAL)

☐ SPARE IMPELLER

☐ TYPE OF SHIPPING PREPARATION AS NOTED ABOVE

REMARKS MOTORS SHALL ALSO BE TOPCOATED ONLY PER SYSTEM 3.3.

REMARKS

REMARKS

WEIGHTS

MOTOR DRIVEN:

WEIGHT OF PUMP 6000 lb

WEIGHT OF BASEPLATE 5200 lb

WEIGHT OF MOTOR 4400 lb

WEIGHT OF GEAR SEAL SYS. 700 lb

TOTAL WEIGHT 16,300 lb

TURBINE DRIVEN:

WEIGHT OF BASEPLATE lb

WEIGHT OF TURBINE lb

WEIGHT OF GEAR lb

TOTAL WEIGHT lb

REMARKS

REMARKS

OTHER PURCHASE REQUIREMENTS

☐ COORDINATION MEETING REQUIRED (YES, NO) Yes

☐ REVIEW FOUNDATION DRAWINGS (YES, NO) No

☐ REVIEW PIPING DRAWINGS (YES, NO) Yes

☐ OBSERVE PIPING CHECKS (YES, NO) No

☐ OBSERVE INITIAL ALIGNMENT CHECK (YES, NO) No

☐ CHECK ALIGNMENT AT OPERATING TEMPERATURE (YES, NO) No

☐ CONNECTION DESIGN APPROVAL (YES, NO) Yes

REVISION



CENTRIFUGAL PUMP (API-610e)

DATA SHEET

PROJECT NO. 53-BK65-42

ITEM NO. 67-5295

REVISION 0

DATE 5/22/04

SHEET 3 OF 3

PLANT: CPCM

PROJECT: PSFC RESTRUCTURING

OTHER PURCHASER REQUIREMENTS (CONT.)

- 1
- 2 ☐ ROBBING DEVICE REQ'D FOR TYPE OH3 PUMP (5.1.2.7)
- 3 ☐ HYDRODYNAMIC THRUST BRG SIZE REVIEW REQ'D (5.2.5.2.4)
- 4 ☒ LATERAL ANALYSIS REQUIRED (5.1.3.3.5.2.4.1) (YES, NO) Yes
- 5 ☐ ROTOR DYNAMIC BALANCE (5.2.4.2) (YES, NO) Yes
- 6 ☒ MOUNT SEAL RESERVOIR OFF BASEPLATE (3.5.1.4) (YES, NO) No
- 7 ☒ INSTALLATION LIST IN PROPOSAL (5.2.3.1) (YES, NO) Yes
- 8 ☐ SPARE ROTOR VERTICAL STORAGE (5.2.9.2) (YES, NO)
- 9 ☐ TORSIONAL ANALYSIS/REPORT (2.8.2.6) (YES, NO)
- 10 ☐ PROGRESS REPORTS REQUIRED (5.3.4) (YES, NO) Yes

REMARKS:

QA INSPECTION AND TEST

- 15 ☐ REVIEW VENDORS QA PROGRAM (4.1.7) (YES, NO) Yes
- 16 ☐ PERFORMANCE CURVE APPROVAL (YES, NO) Yes
- 17 ☐ SHOP INSPECTION (4.1.4) (YES, NO) Yes
- 18 ☒ TEST WITH SUBSTITUTE SEAL (4.3.3.1.2) (YES, NO) No

TEST REQUIREMENT (NON-WIT, WIT, OBSERVE)

20 HYDROSTATIC (4.3.2) Witnessed

21 PERFORMANCE (4.3.3) Witnessed

22 NPSH (4.3.4.1) NONE

23 COMPLETE UNIT TEST (4.3.4.2)

24 SOUND LEVEL TEST (4.3.4.3)

25 ☐ CLEANLINESS PRIOR TO Witnessed

26 FINAL ASSEMBLY (4.2.3.1)

27 ☐ NOZZLE LOAD TEST (3.3.8)

28 ☐ BRG HSG RESONANCE

29 TEST (4.3.4.6)

30 ☐ REMOVE/INSPECT

31 HYDRODYNAMIC BEARINGS

32 AFTER TEST (5.2.6.5)

33 ☐ AUXILIARY EQUIPMENT Witnessed (PIPING, POTS HYDRO)

34 TEST (4.3.4.4)

35 ☐ VIBRATION TEST SHALL BE WITNESSED WITH PERFORMANCE TEST

36 ☐

37 ☐ MATERIAL CERTIFICATION REQUIRED (2.11.1.7) FOR:

38 CASING Yes SHAFT Yes

39 IMPELLER Yes OTHER Yes (POTS, PIPING)

40 ☐ CASTING REPAIR PROCEDURE APPROVAL REQ'D (2.11.2.5) Yes

41 ☐ INSPECTION REQUIRED FOR CONNECTION WELDS (2.11.3.5.6)

42 MAG PARTICLE LIQUID PENETRANT

43 RADIOGRAPHIC Yes ULTRASONIC

44 ☐ INSPECTION REQUIRED FOR CONNECTION CASTINGS (4.2.1.3)

45 MAG PARTICLE LIQUID PENETRANT Yes

46 RADIOGRAPHIC ULTRASONIC

47

48 REMARKS:

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QA INSPECTION AND TEST (CONT.)

☐ ADDITIONAL INSPECTION REQUIRED FOR:

MAG PARTICLE LIQUID PENETRANT (4.2.1.3)

RADIOGRAPHIC ULTRASONIC

☐ ALTERNATE ACCEPTANCE CRITERIA (SEE REMARKS) (4.2.2.1)

☐ HARDNESS TEST REQUIRED FOR:

PRESSURE RETAINING WELDS IN PRESSURE VESSELS, PIPING (4.2.3.2)

☐ WETTING AGENT HYDROTEST (4.3.2.5) (YES, NO) Yes

☐ VENDOR SUBMIT TEST PROCEDURES (4.3.1.2/8.2.5) (YES, NO) Yes

☐ RECORD FINAL ASSEMBLY RUNNING CLEARANCES (YES, NO) Yes

☐ INSPECTION CHECK-LIST (APPENDIX M) (4.1.6) (YES, NO)

REMARKS

GENERAL REMARKS

REMARK 1: ALL PRESSURE RETAINING WELDS WHICH CANNOT BE

X-RAYED SHALL BE LIQUID PENETRANT TESTED

(NON-WITNESSED)



JACOBS P.O. 58-BK6560-HH000583
ITEM # 67-5095
RL2 REACTOR CIRCULATION
PUMP
SAP # 10533692

QUALITY SYSTEM PROCEDURE

Title: Pressure Test Procedure	Procedure No.: 6110.03
	Revision: 6
	Date: 1 March 2004
	Page: i

JACOBS P.O. 58-BK6560-HH000583
ITEM # 67-5095
RL2 REACTOR CIRCULATION
PUMP
SAP # 10533692

APPROVAL SIGNATURES

Orig. Dept.: David J. Beattie /s/ Date: 3/1/04 (QA)

Reviewed By: Michael Furey /s/ Date: 3/1/04 (MAN)

Reviewed By: Jason Allaire /s/ Date: 3/1/04 (ENG)

Training Summary (most recent revision):

WI-1, Pressure Tests of Assemblies, is canceled because it is redundant with this procedure. Other general enhancements are made. The pressure test record card is revised to require additional information concerning the gage(s) used in pressure testing.

JACOBS ENGINEERING GROUP INC - CENTRAL REGION		
PROJECT NO. 58-BK65-40	P.O. NO. 1006583	SERIAL NO.
SIGNATURE/DATE <i>[Signature]</i> 1/21/06	ITEM NO. 67-5095	SUSPENSE DATE 21 2006
NO COMMENTS		
UNLESS COMMENTS NOTED-REVISE, RESUBMIT.		
PROCEED WITH FABRICATION		
D C UNACCEPTABLE - DO NOT PROCEED WITH FABRICATION		
D R FOR INFORMATION ONLY		
Review of this drawing by Jacobs Engineering Group does not relieve the supplier of his responsibility to supply the materials in accordance with the procurement documents.		

This document is CONTROLLED for screen viewing. As a printed document it is NOT CONTROLLED.
Date Printed: December 3, 2004

QUALITY SYSTEM PROCEDURE

Title: Pressure Test Procedure	Procedure No.: 6110.03
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LIST OF EFFECTIVE PAGES

<u>Page</u>	<u>Revision</u>
i	6
ii	6
1	6
2	6
3	6
4	6
5	6
Attachment 1	6

SUPPORTING WORK INSTRUCTIONS

<u>Number</u>	<u>Title</u>	<u>Orig. Dept.</u>	<u>User Dept.</u>
WI-1	Canceled		
WI-2	Selection of Pressure Gage Range	Quality	Mfg.
WI-3	Chlorine Pump Emergency Seal Test	Engineering	Mfg.
WI-2 to 6110.12	Water Testing	Quality	Quality

Title: Pressure Test Procedure

Procedure No.: 6110.03

Revision: 6

Date: 1 March 2004

Page: 1

1.0 PURPOSE

- 1.1 This document establishes a procedure for pressure testing pump pressure retaining elements, either as individual parts or as completed assemblies.
- 1.2 This procedure is written in support of Sections 7-3 and 8-2 of the LPI Quality Manual and Paragraphs 7.3.5, 7.3.6, and 8.2.4 of ISO 9001:2000.

2.0 SCOPE

- 2.1 This procedure establishes the methods to test pressure retaining elements and to document these tests. Special procedures required to test certain elements will be handled by job specific supplements to this procedure.
- 2.2 Customer specifications will not negate any testing considered by Lawrence Pumps to be additionally required.

3.0 RESPONSIBILITY

- 3.1 Engineering is responsible to specify the pressure test requirements and parameters on the test specifications data sheets to be applied to a particular order. These requirements and parameters are transferred to the BOM part technical description.
 - 3.1.1 In specifying pressure test parameters, consideration shall be given to the nil ductility transition temperature of the material being tested, and to the strength of the material being tested at the design operating temperature relative to the strength of the material at the test temperature.
- 3.2 Manufacturing is responsible to conduct the pressure test in accordance with the requirements set forth in

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this procedure, following the parameters set forth in the technical description and the test specifications data sheets. Manufacturing shall complete the Pressure Test Record Card (Attachment 1) upon completion of each test.

- 3.3 Contracts is responsible to collect pressure test records, submit copies to the customer when required, and file them in the job file.

4.0 PROCEDURE

4.1 Test Pressure, Medium, Temperature and Duration

Test pressure, medium, temperature and duration will be indicated on the test specifications sheets by the cognizant Engineer. These requirements are also included in the BOM technical description.

4.1.1 Medium

Water is the normal test medium. In certain instances, because of the difficulty in removing water, problems with internal rusting, contamination, concern regarding the surface tension property of water, or other special test requirements, another medium such as compressed air, nitrogen, steam, kerosene, etc. may be used with the necessary precautions. If the test medium is to be other than city tap water at ambient temperature, this requirement will be detailed in the test specification data sheet and the BOM technical description.

- 4.1.1.1 LPI tests the city tap water periodically for chloride content and other qualities as detailed in Work Instruction WI-2 to Procedure 6110.12.

4.1.2 Temperature

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The item being tested is normally at ambient shop temperature and the test medium (water) is at ambient shop/city water system temperature. If other than ambient temperature is required, such as a steam test, the pressure retaining element shall be brought to temperature slowly and evenly to prevent thermal shock.

4.1.3 Duration

When API 610 is invoked or the item being pressure tested is to be an ASME code vessel, the duration of the pressure test will be at least 30 minutes.

4.1.3.1 Unless otherwise specified, the duration of a pressure test is 15 minutes per inch of maximum wall thickness, but in no case less than 10 minutes at the test pressure and temperature.

4.2 Test Procedure

4.2.1 Assembly and Gaskets

Visually inspect parts, particularly all gasketed mating surfaces, to ensure no checks, cracks, etc. that can leak, exist. If a questionable area is located, notify the supervisor before proceeding. Assemble the flanges with proper gaskets.

4.2.1.1 Temporary gaskets will be used during pressure testing.

4.2.1.2 Temporary gaskets must be able to withstand the pressure and other conditions of the test. Leakage of joints made with temporary gaskets is not acceptable because there is generally no reasonable way to ascertain that the cause of the leak is the gasket

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	Revision: 6
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itself and not a fault in the joint the gasket is intended to seal.

4.2.2 Pressure Gages

A calibrated, uniquely numbered pressure gage shall be used for the test. The range of the gage shall be 1.5 to 4 times the test pressure. Gage accuracy will be +/- 1% of full scale. Pressure gages will be located at the top of the part. They may be connected to the vent line.

4.2.2.1 For all ASME code vessel pressure tests, two pressure gages of the appropriate range are required to be used.

4.2.3 Vents

A valved vent shall be provided at the highest point of the part to allow air to be eliminated when testing with a liquid and to reduce pressure when testing is completed.

4.2.4 Pressurizing the Part

CAUTION

Fill the pressure retaining element with the correct medium at the proper temperature and allow the medium to flow freely to expel any air. Close the vent and slowly bring the medium up to the designated test pressure -0 + 10%, taking all necessary safety precautions to prevent personnel casualty should a rupture occur.

NOTE: On certain parts where a check of particular areas is desired without filling the pressure retaining element with liquid, the part can be tested on 10 psig dry air as a preliminary check prior to testing in accordance with the test

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requirements. This is done at the discretion of the supervisor and is not required to be documented.

4.2.5 Examination for Leaks

Maintain the required pressure for the required length of time. Examine all pressure boundaries for leaks during this time. A leak through the pressure boundary will be cause for rejection. This includes gasket leaks in joints where at least one side is part of the object or assembly being pressure tested.

4.2.5.1 Leaks that are isolated exclusively to equipment used to establish the pressure test are not of concern as long as they do not preclude maintaining the required pressure in the item being tested.

4.2.6 Test Conclusion

Depressurize the item. Vent and drain the test medium as appropriate. Disassemble, clean, and dry the tested item as appropriate.

4.2.7 Repair

Should a repair be required, the test technician shall notify the supervisor who is responsible to ensure the repair is performed in accordance with applicable procedures.

4.2.8 Retesting when Required

Any part repaired as a result of a leak shall be retested in accordance with section 4.2.

4.3 Pressure Test Record Card

4.3.1 Upon successful completion of all pressure testing, and prior to release of a part, the

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test technician shall complete and sign the Pressure Test Record Card. The test technician shall describe any repairs regardless of size or type, and shall indicate the location of the repairs, using a sketch on the reverse side of the test card.

- 4.3.2 The completed Pressure Test Record Card will be forwarded to Contracts. If required by the customer, a copy of the card is forwarded to the customer in the final documentation package.
- 4.3.3 Contracts will make Pressure Test Record Card part of the permanent job file.



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Date: 1 March 2004

Page: Attachment 1



PRESSURE TEST RECORD CARD

SHOP ORDER _____ CUSTOMER _____ PART _____

PATT. NO. _____ DWG. NO. _____ MAT'L _____

TEST PRESS. _____ PSIG TEST MEDIUM _____ TEMP. _____ °F

DURATION _____ MIN. PROCEDURE _____

TEST WITNESSED: YES ☐ NO ☐

NOTES:

GAGE I.D. NO. _____	GAGE RANGE 0- _____	CAL. DUE DATE _____
_____	0- _____	_____

REPAIR REQUIRED YES ☐ NO ☐

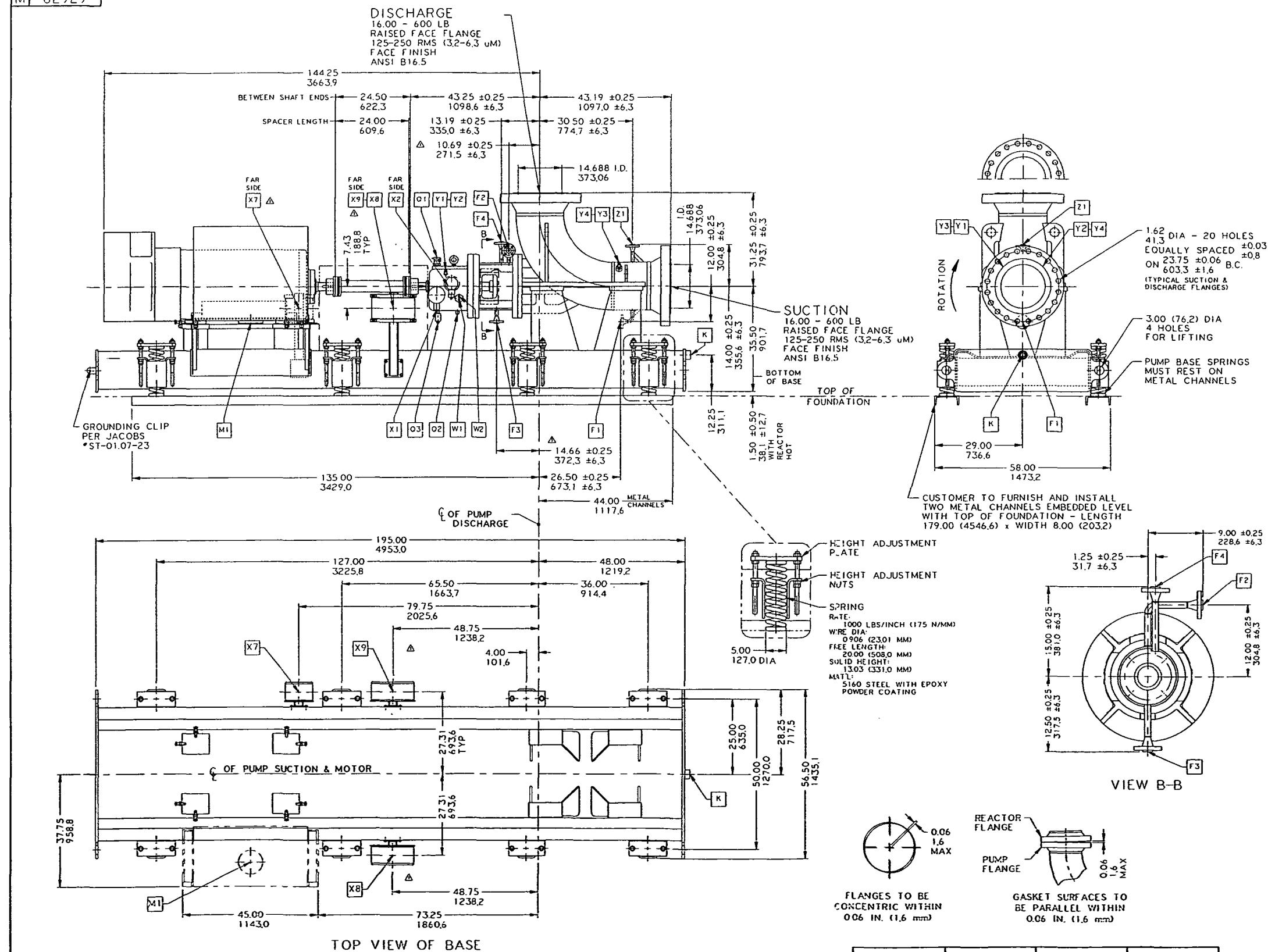
USE REVERSE SIDE TO DESCRIBE ALL REPAIRS

REPAIR PROCEDURE _____

PART ACCEPTED AND RELEASED YES ☐ NO ☐

DATE TESTED _____ TESTER _____

WITNESSED BY: _____



NOTES:

- FOR PUMP CROSS SECTION SEE DRAWING NO.: M62930
- FOR LIST OF COMPONENTS SEE LOC92071
- FOR LIST OF CONNECTIONS SEE DRAWING NO.: M62929-SHEET 4
- ALL FLANGES CONFORM TO ANSI B16.5. ALL FLANGE DRILLING TO STRADDLE CENTERLINES EQUALLY
- PRIMARY SEAL OIL SYSTEM (API PLAN 53) TO BE DIS-ASSEMBLED FROM PUMP (BY L.P.I.) FOR SHIPMENT AND RE-INSTALLED AT SITE BY CUSTOMER PER DRAWING NO.: M62929-SHEET 2
- SAFETY SEAL OIL SYSTEM (API PLAN 52) TO BE DIS-ASSEMBLED FROM PUMP (BY L.P.I.) FOR SHIPMENT AND RE-INSTALLED AT SITE BY CUSTOMER PER DRAWING NO.: M62929-SHEET 3
- L.P.I. TO WIRE ALL INSTRUMENTATION LEADS FOR PUMP, PRIMARY SEAL OIL SYSTEM, SAFETY SEAL OIL SYSTEM AND MOTOR MONITORING SYSTEMS TO COMMON JUNCTION BOXES MOUNTED ON PUMP BASE. FOR JUNCTION BOX TERMINAL CONNECTION DIAGRAMS SEE DRAWING NO.S: C62984 - ANALOG SYSTEMS
C62985 - DC SYSTEMS
C62986 - TEMPERATURE SYSTEMS
- ALL INTERNAL PROCESS WETTED PASSAGES OF PUMP TO HAVE A SURFACE FINISH OF 63 RMS (1.6 μ m) MAX.
- FOR PIPING & INSTRUMENT DIAGRAM (P&ID) OF PUMP & MOTOR SYSTEMS SEE DRAWING NO.: D62967
- OPERATING TEMPERATURE OF PUMP BEARING OIL NOT TO EXCEED 180° F (82° C).
- LEVEL SWITCH FOR PUMP BEARING HOUSING OIL LEVEL IS PERMANENTLY SET AT 3.00" (76.2 MM) BELOW CENTERLINE OF PUMP SHAFT
- PUMP CASING ELBOW IS DESIGNED, BUILT AND "U" STAMPED PER ASME SECTION VIII, DIV. 1

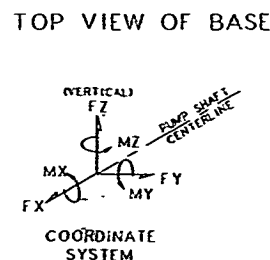
WEIGHTS:

PUMP (LESS BASE):	6000 LBS	2722 KGS
BASE:	5200 LBS	2359 KGS
COUPLING:	51 LBS	23 KGS
COUPLING GUARD:	35 LBS	16 KGS
MOTOR:	4400 LBS	1996 KGS
PRIMARY SEAL OIL SYSTEM:	300 LBS	136 KGS
SAFETY SEAL OIL SYSTEM:	350 LBS	159 KGS
TOTAL:	16336 LBS	7411 KGS
MOTOR ROTOR:	930 LBS	422 KGS
PUMP ROTATING ELEMENT:	210 LBS	96 KGS

DRIVER DATA:

MFR:	SIEMENS
FRAME SIZE:	509SY
POWER:	250 HP (186 KW)
SPEED:	1800 RPM
VOLTAGE:	4000
PHASE:	3
HERTZ:	60
ENCLOSURE:	TEFC
AREA CLASS:	CL.I, GRC/D, DIV.2

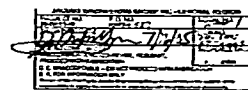
COORDINATE SYSTEM	SUCTION FLANGE	DISCHARGE FLANGE
FX	2300 LBS	10230 N
FY	1900 LBS	8450 N
FZ	1500 LBS	6670 N
FR	3300 LBS	14850 N
MX	5400 FT-LBS	7320 N-M
MY	2700 FT-LBS	3660 N-M
MZ	4000 FT-LBS	5420 N-M
MR	7200 FT-LBS	9820 N-M



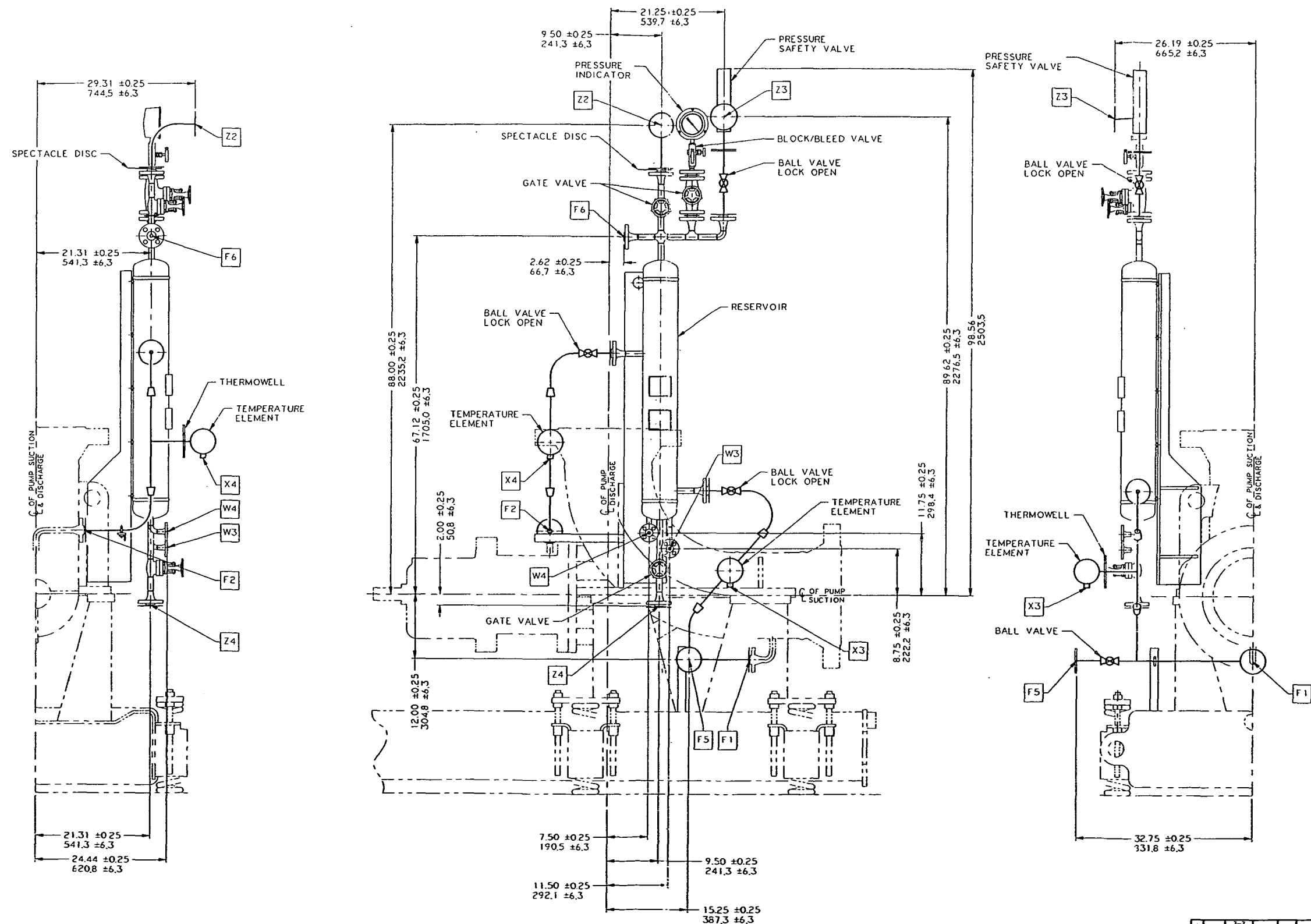
92071	58-BK6540-HH000583	67-5095-10533692	30-5095-10533693
PUMP SERIAL NO.	ORDER NO.	PUMP ITEM NO. SAP NO.	MOTOR ITEM NO. SAP NO.
CUSTOMER:	JACOBS ENGINEERING		
USER:	CHEVRON PHILLIPS		
PLANT:	CPCHEM		
LOCATION:	PASADENA, TEXAS		
SERVICE:	RL2 CIRCULATION PUMP		
PROJECT NO.:	58-BK65-40		
PROJECT:	PSPC RESTRUCTURING		

ALL DIMENSIONS ARE IN INCHES UNLESS OTHERWISE SPECIFIED
 UNTOLERANCED DIMENSIONS ARE FOR REFERENCE ONLY
 DO NOT USE FOR CONSTRUCTION PURPOSES UNLESS CERTIFIED

2	CZ	7-7 OS	K2	SEE SHEET 4
1	CZ	2-3 OS	K2	ALSO SEE SHEETS 2 ELEC JUNCTION BOXES SHOWN & DIMS ADDED CIMS 1444, 1319, 1049 ENLARGED BY 0.06 PUMP & MOTOR SAP NOS. ADDED-ORDER NO. WAS HH 000583-NOTE IT WAS SET AT 2.75" WEIGHTS MODIFIED
BY	DATE	CHKD		DESCRIPTION
REVISIONS				
DIMENSIONAL OUTLINE (GA) OF 16 x 16 SERIES 9500 HORIZONTAL REACTOR CIRCULATION PUMP				
CMD	CZ	CHGD	K2	12-3
DATE	12-1-04	ENG	GCM	
SCALE	NONE			
CAD DATABASE				DRAWING NUMBER
M 62929				1 OF 4



LAWRENCE PUMPS INC.
LAWRENCE, MASS.



NOTES:


1. FOR PUMP DIMENSIONAL OUTLINE (G.A) SEE DRAWING NO: M62929-SHEET 1
2. FOR LIST OF CONNECTIONS & COMPONENT DATA SEE DRAWING NO: M62929-SHEET 4
3. ALL FLANGES CONFORM TO ANSI B16.5
ALL FLANGE DRILLING TO STRADDLE CENTERLINES EQUALLY

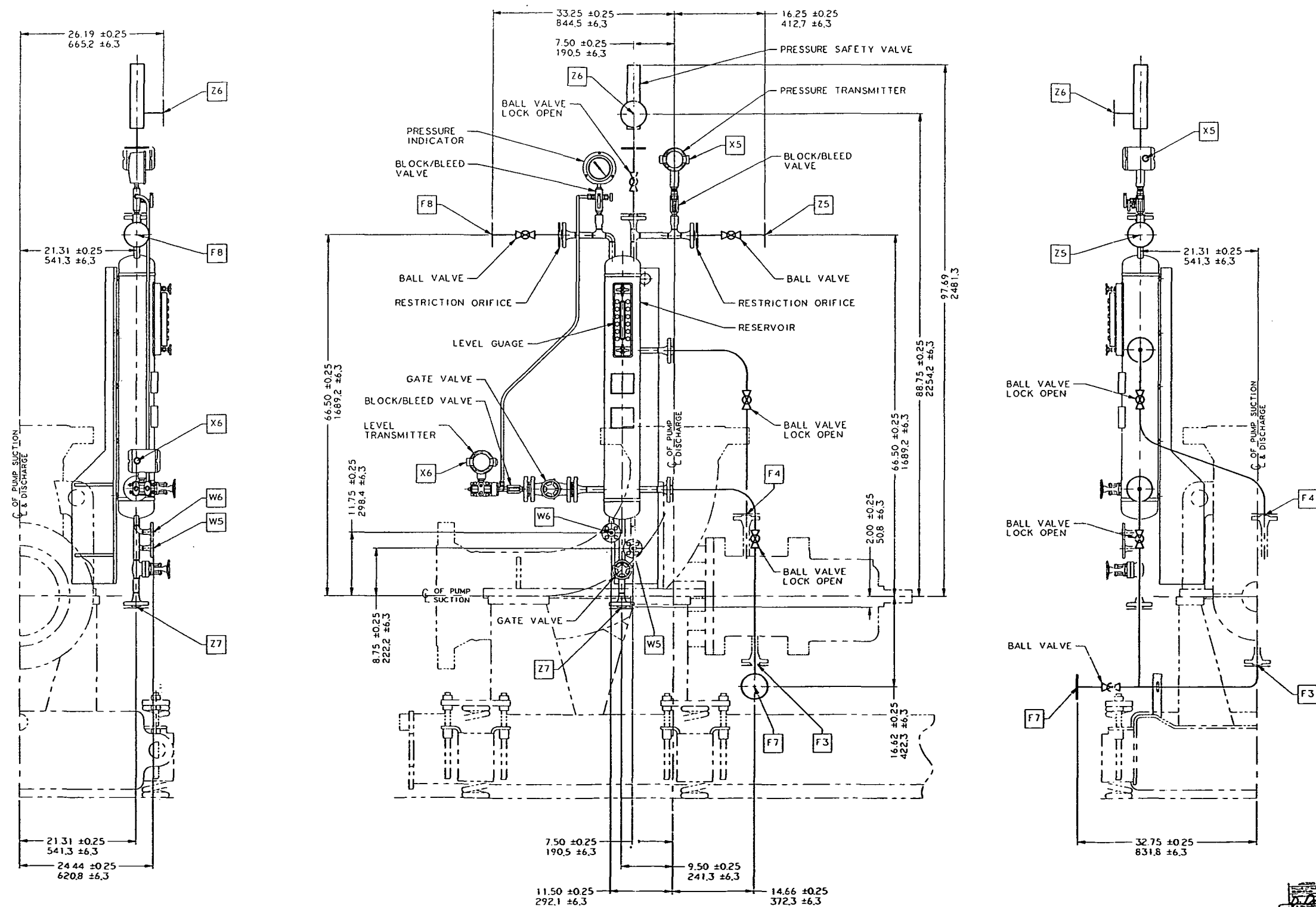
92071	58-BK6560- MH000583	67-5095 10533692	30-5095 10533693
PUMP SERIAL NO.	ORDER NO.	PUMP ITEM NO SAP NO	MOTOR ITEM NO SAP NO
CUSTOMER: USER: PLANT: LOCATION: SERVICE: PROJECT NO: PROJECT:	JACOBS ENGINEERING CHEVRON PHILLIPS CPCHEM PASADENA, TEXAS RL2 CIRCULATION PUMP 58-BK65-40 PSPC RESTRUCTURING		

DIMENSIONS ARE IN INCHES
MILLIMETERS

UNTOLERANCED DIMENSIONS
ARE FOR REFERENCE ONLY

DO NOT USE FOR CONSTRUCTION
PURPOSES UNLESS CERTIFIED

2	CZ	1-7 GS	K2		SEE SHEET 4
1	CZ	2-7 CS	K2		ALSO SEE SHEETS 1 PUMPS & DISCHARGE RECONFIGURED-FRES. TRANSMITTER REMOVED-TEMP. ELEMENTS ADDED PRESSURE SAFETY VALVE & BALL VALVE ADDED CIST. DATA BLOCK UPDATED
30	BY	DATE	CHKD		DESCRIPTION
REVISIONS					
DIMENSIONAL OUTLINE (GA.) OF PRIMARY SEAL OIL SYSTEM FOR 16 x 16 SERIES (9A) REACTOR CIRCULATION PUMP					
ENG	CZ	CHKD	K2	12-3	 LAWRENCE PUMPS INC. LAWRENCE, MASS.
DATE:	12-1-04	ENG	GCM		
SCALE:	NONE				
CAD DATABASE					DRAWING NUMBER
FILE	14-2929	CZ	07	OFFICE	M 62929 <div style="float: right;">SHEET 4</div>



NOTES:

1. FOR PUMP DIMENSIONAL OUTLINE (G.A.) SEE DRAWING NO: M62929-SHEET 1
2. FOR LIST OF CONNECTIONS & COMPONENT DATA SEE DRAWING NO: M62929-SHEET 4
3. ALL FLANGES CONFORM TO ANSI B16.5
ALL FLANGE DRILLING TO STRADDLE CENTERLINES EQUALLY

92071	58-BK6560-HH000583	67-5095 10533692	30-5095 10533693
PUMP SERIAL NO.	ORDER NO	PUMP ITEM NO. SAP NO.	MOTOR ITEM NO. SAP NO.
CUSTOMER:	JACOBS ENGINEERING		
USER:	CHEVRON PHILLIPS		
PLANT:	CPCHEM		
LOCATION:	PASADENA, TEXAS		
SERVICE:	RL2 CIRCULATION PUMP		
PROJECT NO:	58-BK65-40		
PROJECT:	PSPC RESTRUCTURING		

DIMENSIONS ARE IN INCHES
UNLESS OTHERWISE SPECIFIED
UNTOLERANCED DIMENSIONS
ARE FOR REFERENCE ONLY
DO NOT USE FOR CONSTRUCTION
PURPOSES UNLESS CERTIFIED

2	CZ	2-3	K2		SEE SHEET 4
1	CZ	2-3	K2		SEE SHEETS 1 & 2
BY	DATE	CHKD			DESCRIPTION
REVISIONS					
DIMENSIONAL OUTLINE (G.A.) OF SAFETY SEAL OIL SYSTEM FOR 16 x 16 SERIES 9500 REACTOR CIRCULATION PUMP					
DATE	12-1-04	CHKD	K2	12-3	
SCALE	NONE	ENG	GCM		
CAD DATABASE				DRAWING NUMBER	
CZ FILE NO. M62929				M	62929
DATE OF TELE				3	4

COMPONENT DATA:

RESERVOIRS:	JOHN CRANE LEMCO 5 GALLON (18.9 LITERS) MAWP = 1000 PSIG (68.9 BARG) AT 302 F (150 C) MDMT = -49 F (-45 C) AT 1000 PSIG (68.9 BARG) 316L SS (ASTM SA312, SA403)
PIPING:	SCH 80 (BUTT WELDED & FLANGED) 316/316L SS (ASTM A312 SEAMLESS)
FITTINGS:	SCH 80 (BUTT WELD) 316/316L SS (ASTM A403)
GASKETS:	SPIRAL WOUND STAINLESS STEEL
FASTENERS:	HEX CAPSCREWS - CARBON STEEL (DIN 931 CL. 8.8) HEX NUTS - CARBON STEEL (DIN 934 CL. 8) STUD BOLTS - CARBON STEEL (DIN 975 CL. 8.8)
FLANGES:	SCH 80 (WELD NECK) 316/316L SS (ASTM A182)
BALL VALVES:	NELES-JAMESBURY, INC. SERIES 4000 - FIRE-TITE 316L SS (ASTM A351-GR.CF8M) BODY 316 SS BALL AND STEM FILLED TFE SEAT CARBON STEEL BODY FASTENERS (ASTM A193-GR.B7, A194-GR.2H)
GATE VALVES:	SUPPLIED WITH RESERVOIRS (SEE JOHN CRANE LEMCO DRAWINGS)
BLOCK/BLEED VALVES:	SUPPLIED WITH RESERVOIRS (SEE JOHN CRANE LEMCO DRAWINGS)
PRESSURE SAFETY VALVES:	CONSOLIDATED (DRESSER INDUSTRIES) 19000(S4) SERIES - FLANGED 316 SS WETTED MATERIALS SET AT 1000 PSIG (68.9 BARG) ASME SECTION VIII CERTIFIED
LEVEL GUAGE:	SUPPLIED WITH RESERVOIRS (SEE JOHN CRANE LEMCO DRAWINGS)
LEVEL TRANSMITTER:	SUPPLIED WITH RESERVOIRS (SEE JOHN CRANE LEMCO DRAWINGS)
PRESSURE INDICATORS:	SUPPLIED WITH RESERVOIRS (SEE JOHN CRANE LEMCO DRAWINGS)
PRESSURE TRANSMITTER:	SUPPLIED WITH RESERVOIRS (SEE JOHN CRANE LEMCO DRAWINGS)
LEVEL SWITCH:	MAGNETROL THERMATEL MODEL: TDL THERMAL DISPERSION TWIN TIP SENSOR WITH ATEX CERTIFICATION
TEMPERATURE ELEMENTS (RTD'S):	OMEGA MODEL: PR-12 INDUSTRIAL RTD PROBE WITH CAST IRON HEAD 100 OHM - 3 WIRE CONFIGURATION
VIBRATION ELEMENT:	BENTLY NEVADA MODEL: 330525 VELOMITOR XA PIEZO VELOCITY SENSOR WITH CENELEC CERTIFICATION

LIST OF CONNECTIONS:

F1	3/4" - 600 LB RF FLANGE - INLET TO PRIMARY SEAL AND INBOARD RADIAL BEARING BARRIER FLUID: TURBINE QUALITY MINERAL OIL VISCOSITY: ISO 68 FLOW RATE: 1.0 - 2.0 USGPM (0.23 - 0.45 M3/H) PRESSURE: 20 - 50 PSIG (1.4 - 3.4 BARG) ABOVE PUMP DISCHARGE PRESSURE	X1	3/4" NPT - CONDUIT ENTRY TO THRUST BEARING HOUSING OIL LEVEL SWITCH (SEE SHEET 1, NOTE 11)
F2	3/4" - 600 LB RF FLANGE - OUTLET FROM PRIMARY SEAL AND INBOARD RADIAL BEARING	X2	1/2" NPT - CONDUIT ENTRY TO THRUST BEARING TEMPERATURE ELEMENT (RTD) (SEE SHEET 1, NOTE 10)
F3	3/4" - 600 LB RF FLANGE - INLET TO SAFETY SEAL BUFFER FLUID: TURBINE QUALITY MINERAL OIL VISCOSITY: ISO 68 FLOW RATE: 0.5 - 1.0 USGPM (0.11 - 0.23 M3/H) PRESSURE: ATMOSPHERIC	X3	1/2" NPT - CONDUIT ENTRY TO PRIMARY SEAL OIL FEED LINE TEMPERATURE ELEMENT (RTD)
F4	3/4" - 600 LB RF FLANGE - OUTLET FROM SAFETY SEAL	X4	1/2" NPT - CONDUIT ENTRY TO PRIMARY SEAL OIL RETURN LINE TEMPERATURE ELEMENT (RTD)
F5	3/4" - 600 LB RF FLANGE - PRIMARY SEAL OIL SYSTEM FILL/DRAIN (WITH BLIND FLANGE)	X5	1/2" NPT - CONDUIT ENTRY TO SAFETY SEAL OIL RESERVOIR PRESSURE TRANSMITTER (SEE JOHN CRANE LEMCO DRAWINGS)
F6	3/4" - 600 LB RF FLANGE - OIL INLET TO PRIMARY SEAL OIL RESERVOIR	X6	1/2" NPT - CONDUIT ENTRY TO SAFETY SEAL OIL RESERVOIR LEVEL TRANSMITTER (SEE JOHN CRANE LEMCO DRAWINGS)
F7	3/4" - 600 LB RF FLANGE - SAFETY SEAL OIL SYSTEM DRAIN (WITH BLIND FLANGE)	X7	CABLE GLAND FOR 11.1mm TO 19.9mm O.D. CABLE - INLET TO INSTRUMENTATION JUNCTION BOX FOR DC SYSTEMS
F8	3/4" - 600 LB RF FLANGE - OIL INLET TO SAFETY SEAL OIL RESERVOIR	X8	CABLE GLAND FOR 11.1mm TO 19.9mm O.D. CABLE - INLET TO INSTRUMENTATION JUNCTION BOX FOR TEMPERATURE ELEMENTS
K	2" NPT - BASE DRIP RIM DRAIN	X9	CABLE GLAND FOR 11.1mm TO 19.9mm O.D. CABLE - INLET TO INSTRUMENTATION JUNCTION BOX FOR ANALOG SYSTEMS
M1	MOTOR CONDUIT BOX ENTRY FOR MAIN POWER LEADS	Y1	1/2" NPT - MOUNTING CONNECTION FOR THRUST BEARING VIBRATION ELEMENT (ELEMENT SUPPLIED BY L.P.I.)
Q1	1 1/4" NPT - THRUST BEARING HOUSING OIL FILLER CAP AND BREATHER LUBRICANT: TURBINE QUALITY MINERAL OIL VISCOSITY: ISO 68 CAPACITY: 5.5 QU/RTS (5.2 LITERS) OPERATING TEMPERATURE: 180 F (82 C) MAX	Y2	1/2" NPT - MOUNTING CONNECTION FOR THRUST BEARING VIBRATION ELEMENT (ELEMENT SUPPLIED BY L.P.I.)
Q2	3/4" NPT - THRUST BEARING HOUSING OIL DRAIN (PLUGGED)	Y3	1/2" NPT - MOUNTING CONNECTION FOR INBOARD RADIAL BEARING VIBRATION ELEMENT (ELEMENT SUPPLIED BY L.P.I.)
Q3	1/2" NPT - THRUST BEARING HOUSING OIL SAMPLING LINE (WITH SIGHT BOTTLE & PETCOCK VALVE)	Y4	1/2" NPT - MOUNTING CONNECTION FOR INBOARD RADIAL BEARING VIBRATION ELEMENT (ELEMENT SUPPLIED BY L.P.I.)
W1	1/4" NPT - COOLING WATER INLET TO THRUST BEARING OIL HEAT EXCHANGER	Z1	3/4" - 600 LB RF FLANGE - FLUSH INLET TO SEAL THROAT BUSHING FLUSHING FLUID: CLEAN DILUENT FLOW RATE: 3.0-5.0 USGPM (0.68-1.14 M3/H) PRESSURE: 25 PSIG (1.7 BARG) ABOVE PUMP DISCHARGE PRESSURE
W2	1/4" NPT - COOLING WATER OUTLET FROM THRUST BEARING OIL HEAT EXCHANGER	Z2	3/4" - 150 LB RF FLANGE - VENT FROM PRIMARY SEAL OIL RESERVOIR (TO FLARE)
W3	1/2" - 150 LB RF FLANGE - COOLING WATER INLET TO PRIMARY SEAL OIL RESERVOIR HEAT EXCHANGER	Z3	1" - 150 LB RF FLANGE - VENT FROM PRIMARY SEAL OIL RESERVOIR PRESSURE SAFETY VALVE (TO FLARE)
W4	1/2" - 150 LB RF FLANGE - COOLING WATER OUTLET FROM PRIMARY SEAL OIL RESERVOIR HEAT EXCHANGER	Z4	3/4" - 600 LB RF FLANGE - DRAIN FROM PRIMARY SEAL OIL RESERVOIR (WITH BLIND FLANGE)
W5	1/2" - 150 LB RF FLANGE - COOLING WATER INLET TO SAFETY SEAL OIL RESERVOIR HEAT EXCHANGER	Z5	3/4" - 600 LB RF FLANGE - VENT FROM SAFETY SEAL OIL RESERVOIR (TO FLARE)
W6	1/2" - 150 LB RF FLANGE - COOLING WATER OUTLET FROM SAFETY SEAL OIL RESERVOIR HEAT EXCHANGER	Z6	1" - 150 LB RF FLANGE - VENT FROM SAFETY SEAL OIL RESERVOIR PRESSURE SAFETY VALVE (TO FLARE)
		Z7	3/4" - 600 LB RF FLANGE - DRAIN FROM SAFETY SEAL OIL RESERVOIR (WITH BLIND FLANGE)

NOTES:

1. FOR DIMENSIONAL OUTLINE (G.A.) OF PUMP SEE DRAWING NO: M62929-SHEET 1
2. FOR DIMENSIONAL OUTLINE (G.A.) OF PRIMARY SEAL OIL SYSTEM SEE DRAWING NO: M62929-SHEET 2
3. FOR DIMENSIONAL OUTLINE (G.A.) OF SAFETY SEAL OIL SYSTEM SEE DRAWING NO: M62929-SHEET 3
4. ALL FLANGES CONFORM TO ANSI B16.5
ALL FLANGE DRILLING TO STRADDLE CENTERLINES EQUALLY

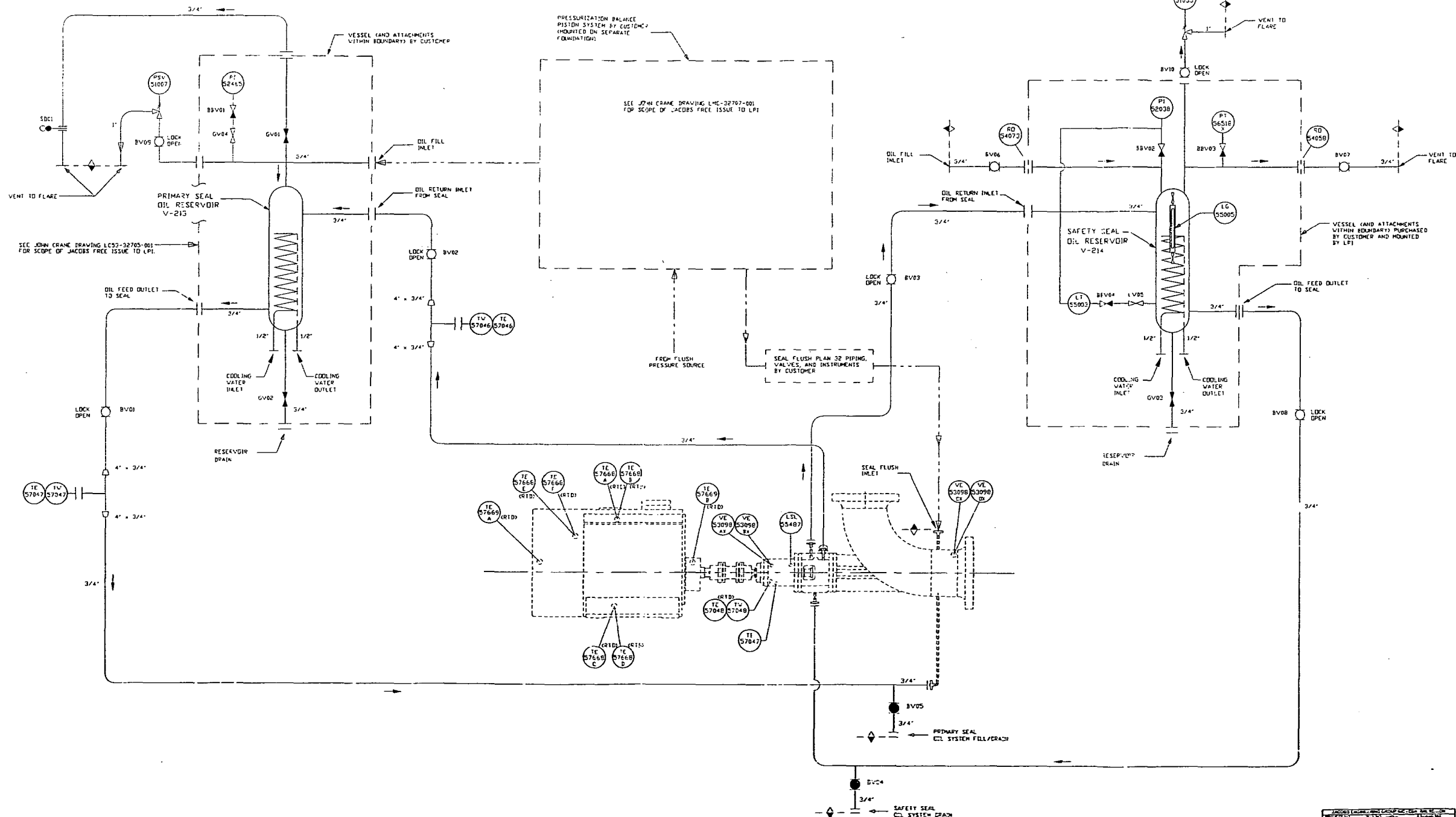
92071	58-BK6560-HH000583	67-509510533692	30-509510533693
PUMP SERIAL NO.	ORDER NO.	PUMP ITEM NO. SAP NO.	MOTOR ITEM NO. SAP NO.
CUSTOMER USER:	JACOBS ENGINEERING		
PLANT:	CHEVRON PHILLIPS		
LOCATION:	CPCHEM		
SERVICE:	PASADENA, TEXAS		
PROJECT NO:	RL2 CIRCULATION PUMP		
PROJECT:	58-BK65-40		
	PSPC RESTRUCTURING		

CONNECTIONS ARE IN INCHES	INCHES
UNTOLERANCED DIMENSIONS ARE FOR REFERENCE ONLY	
DO NOT USE FOR CONSTRUCTION PURPOSES UNLESS CERTIFIED	

2	CZ	7-7	K2		CONNS X1 & X2, NOTE NO. REF. ADDED
1	CZ	2-3	K2		CONNS X5 & X6, CONN. SIZE ADDED
BY	DATE	CHKD			DESCRIPTION
REVISIONS					
LIST OF CONNECTIONS & COMPONENT DATA					
FOR 16 x 16 SERIES 9500 REACTOR CIRCULATION PUMP					
OWN	CZ	CHD	K2	12-3	
DATE	12-1-04	ENG	GCM		
SCALE	NONE				
CAD DATABASE					
DRAWING NUMBER					
M 62929					
SHEET 4 OF 4					

NOTES:

1. SCOPE OF SUPPLY:
BY LPI BY CUSTOMER
2. FOR PAID INSTRUMENTS, SEE INSTRUMENT LIST 1162967.



LEGEND

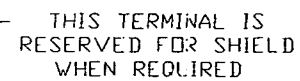
- LEVEL GAUGE
LEVEL SWITCH LOW
LEVEL TRANSMITTER
PRESSURE INDICATOR
PRESSURE SAFETY VALVE
PRESSURE TRANSDUCER
RESTRICTION ORIFICE
TEMPERATURE ELEMENT GRTD
THERMOWELL
VIBRATION ELEMENT
RESTRICTION ORIFICE
SPECTACLE DISC
PRESSURE RELIEF VALVE
BALL VALVE NORMALLY CLOSED
BALL VALVE NORMALLY OPEN
GATE VALVE NORMALLY CLOSED
GATE VALVE NORMALLY OPEN
BLOCK/BLIND VALVE
INTERCONNECTING PIPING SUPPLIED BY CUSTOMER
FIELD PIPING

58071	SB-EX6560- H01 000000	67-5095 00000000	30-5095 00000000
PUMP SERIAL NO.	ORDER NO.	PUMP ITEM NO. SAP NO.	MOTOR ITEM NO. SAP NO.
CUSTOMER USER: PLANT: LOCATION: SERVICE: PROJECT NO.	JACOBS ENGINEERING CHEVRON PHILLIPS COPENHAGEN PASADENA, TEXAS RL2 CIRCULATION PUMP SB-EX65-40 PSPE RESTRICTION		

DIMENSIONS ARE IN INCHES
UNTOLERANCED DIMENSIONS
ARE FOR REFERENCE ONLY
DO NOT USE FOR CONSTRUCTION
PURPOSES UNLESS CERTIFIED


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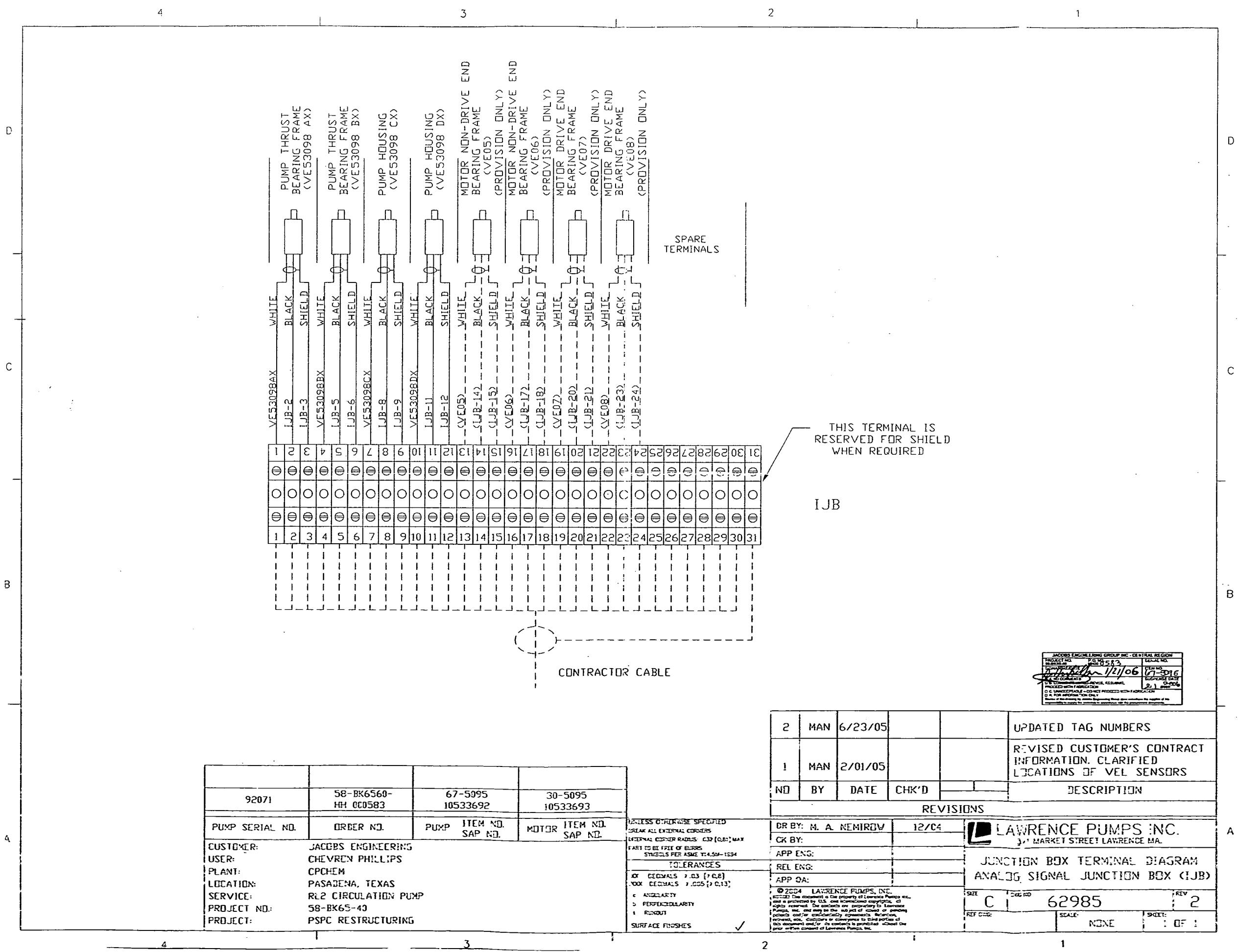
4	ISSN	7/15/2004			CHANGED BY 10 TO OVERHAULED LEGEND
3	ISSN	7/15/2004			REMOVED THERMOWELL FROM S&P
2	ISSN	5/12/2004			REVISED TAG NUMBERS PER CUSTOMER MARKUP
1	ISSN	2/23/02			REVISED CUSTOMER CONTRACT INFORMATION ELABORATED LOCATION OF VIB. SENSORS
NO	BY	DATE	CHK'D	REVISIONS	DESCRIPTION
4	BY: M. A. Ketter	05 DEC 04			
4	BY: GDU/02	10 DEC 04			
4	APP. ENG:				
4	REL. ENG:				
LAWRENCE PUMPS INC. 371 MARKET STREET LAWRENCE, MA, U.S.A.					
P&ID OF PUMP, MOTOR, AND SEAL SYSTEMS FOR 16 X 16 SERIES 9500 HORIZONTAL REACTOR CIRCULATION PUMP					
SIZE	62967	REV	04		
REF. ENG.	SCALE	NONE	SHEET	1 OF 1	



AJB

UNLESS OTHERWISE SPECIFIED	
BREAM ALL EXTERNAL CORNERS	
INTERNAL CORNER RADIUS: R32 (0.5) MAX	
PART TO BE FREE OF BURRS	
STUDIES PER ASME Y14.5M-1994	
TOLERANCES	
XXX DECIMALS	±.03 (±0.5)
XXX DECIMALS	±.005 (±0.13)
C	ANGULARITY
D	PERPENDICULARITY
E	ROUNDNESS
SURFACE FINISHES	

2	MAN	6/23/05		UPDATED TAG NUMBERS
1	MAN	2/01/05		REVISED CUSTOMER'S CONTRACT INFORMATION
NO	BY	DATE	CHK'D	DESCRIPTION
REVISIONS				
DR BY: M. A. NEMIROV		12/04		 LAWRENCE PUMPS INC. 371 MARKET STREET LAWRENCE MA JUNCTION BOX TERMINAL DIAGRAM 120X VDC JUNCTION BOX (AJB)
CK BY:				
APP ENG:				
REL ENG:				
APP QA:				
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C		62984		REV 2
REF CDR:		SCALE:		SHEET: 1 OF 1
		NONE		



92071	58-BK6560-HH 000583	67-5095 10533692	30-5095 10533693
PUMP SERIAL NO.	ORDER NO.	PUMP ITEM NO. SAP NO.	MOTOR ITEM NO. SAP NO.
CUSTOMER: JACOBBS ENGINEERING			
USER: CHEVRON PHILLIPS			
PLANT: CPICHEM			
LOCATION: PASADENA, TEXAS			
SERVICE: RL2 CIRCULATION PUMP			
PROJECT NO: 58-BK65-40			
PROJECT: PSPC RESTRUCTURING			

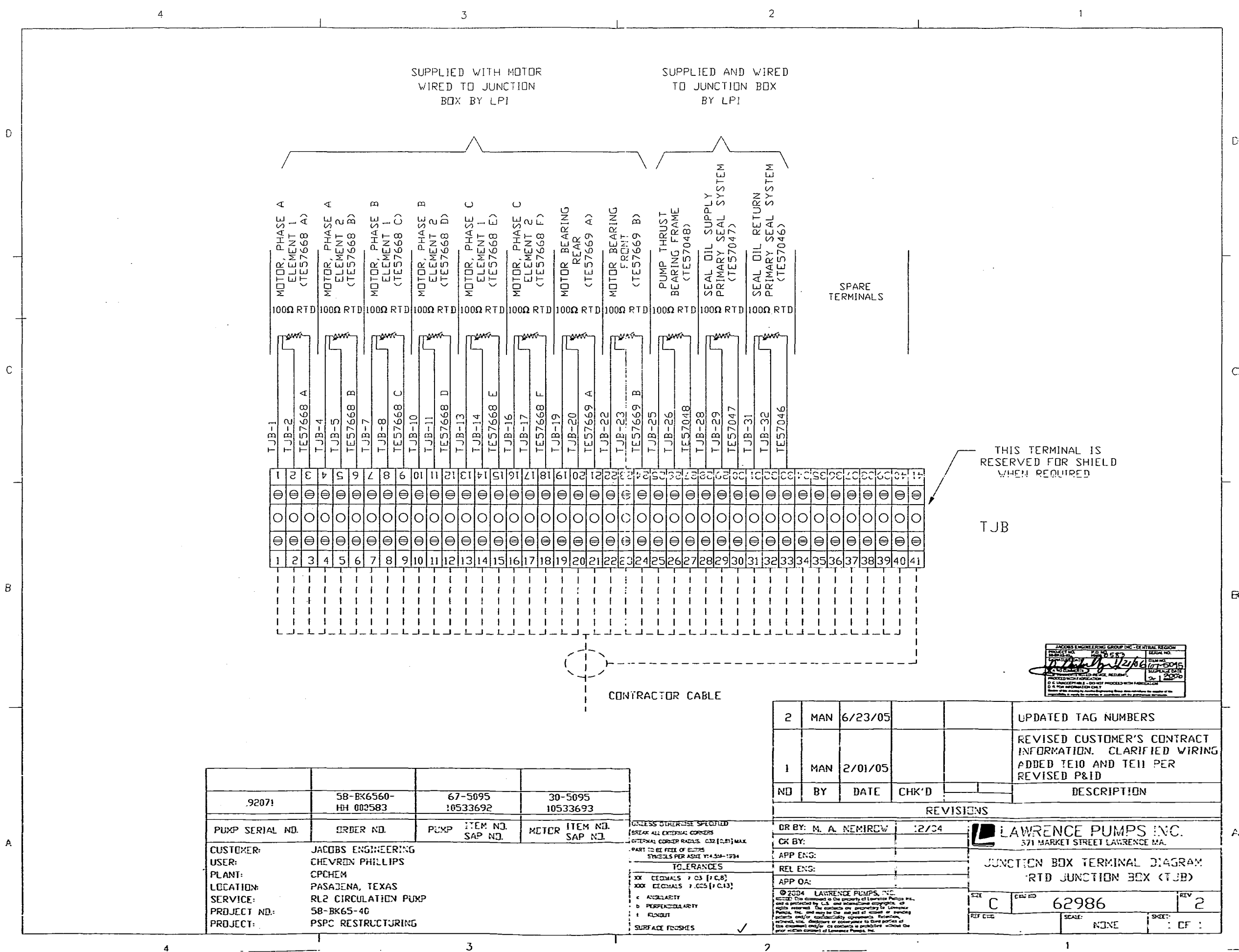
UNLESS OTHERWISE SPECIFIED
BREAK ALL EXTERNAL CORNERS
INTERNAL CORNER RADIUS: R3 (0.125") MAX
PART TO BE FREE OF BURRS
SYMBOLS PER ASME Y14.5M-1994

TOLERANCES
X DECIMALS ±.03 (+0.6)
Y DECIMALS ±.005 (+0.13)

• ANGULARITY
• PERPENDICULARITY
• ROUNDT
SURFACE FINISHES

2	MAN	6/23/05			UPDATED TAG NUMBERS
1	MAN	2/01/05			REVISED CUSTOMER'S CONTRACT INFORMATION. CLARIFIED LOCATIONS OF VEL SENSORS
NO	BY	DATE	CHK'D		DESCRIPTION
REVISIONS					
DR BY: M. A. NEMIROV			12/04	LAWRENCE PUMPS INC. 311 MARKET STREET LAWRENCE MA.	
CK BY:				JUNCTION BOX TERMINAL DIAGRAM ANALOG SIGNAL JUNCTION BOX (IJB)	
APP ENG:				SIZE C	
REL ENG:				62985	
APP QA:				REV 2	
REF CODE:				SCALE: NONE	
				SHEET: 1 OF 1	

JACOBBS ENGINEERING GROUP INC. - CENTRAL REGION
PROJECT NO. 58-BK65-40
DRAWING NO. 67-5095
DATE 12/06
BY M. A. NEMIROV
CHECKED BY M. A. NEMIROV
APPROVED BY M. A. NEMIROV
SCALE: NONE
SHEET: 1 OF 1



92071	58-BK6560-HH 002583	67-5095 10533692	30-5095 10533693
PUMP SERIAL NO.	ORDER NO.	PUMP ITEM NO. SAP NO.	MOTOR ITEM NO. SAP NO.
CUSTOMER:	JACOBS ENGINEERING		
USER:	CHEVRON PHILLIPS		
PLANT:	CPCHEM		
LOCATION:	PASADENA, TEXAS		
SERVICE:	RL2 CIRCULATION PUMP		
PROJECT NO.:	58-BK65-40		
PROJECT:	PSPC RESTRUCTURING		

UNLESS OTHERWISE SPECIFIED
(BREAK ALL EXTERNAL CORNERS
INTERNAL CORNER RADII: 0.02 (0.05) MAX
PART TO BE FREE OF BURRS
STRAIGHTEN PER ASME Y14.5M-1994

TOLERANCES

XX DECIMALS ± 0.03 (0.08)
XXX DECIMALS ± 0.005 (0.013)

✓

SURFACE FINISHES

2	MAN	6/23/05			UPDATED TAG NUMBERS
1	MAN	2/01/05			REVISED CUSTOMER'S CONTRACT INFORMATION. CLARIFIED WIRING ADDED TE10 AND TE11 PER REVISED P&ID
NO	BY	DATE	CHK'D		DESCRIPTION
REVISIONS					
DR BY:	M. A. NEMIREW	12/04			LAWRENCE PUMPS INC. 371 MARKET STREET LAWRENCE, MA.
CR BY:					
APP ENG:					JUNCTION BOX TERMINAL DIAGRAM RTD JUNCTION BOX (TJB)
REL ENG:					
APP QA:					
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SIZE	C	REV NO	62986	REV	2
REF CUE		SCALE	NONE	SHEET	1 OF 1

JACOBS ENGINEERING GROUP INC. - CENTRAL REGION
PROJECT NO. 58-BK65-40
DRAWING NO. 62986
DATE 12/04
BY M. A. NEMIREW
CHECKED BY J. J. JONES
APPROVED BY J. J. JONES
J. J. JONES, P.E.
JACOBS ENGINEERING GROUP INC. - CENTRAL REGION
371 MARKET STREET LAWRENCE, MA. 01904
TEL: 978-681-1234
FAX: 978-681-1234
WWW.JACOBS-ENGINEERING.COM



JACOBS P.O. 58-BK6560-HH000583

ITEM # 67-5095

RL2 REACTOR CIRCULATION
PUMP

SAP # 10533692

PROJECT NO. 58-BK65

ITEM NO. 67-5095

P.O. NO. 58BK6560-HH000583

DATE 9/29/04

INQUIRY NO.

MADE BY DED

APPROVED

REVISION

DATE 4/20/05

SHT. 1 OF 1

EQUIPMENT SOUND LEVEL DATA

LPI Rev. 1

PLANT PASADENA, TEXAS

PROJECT: CHEVRON PHILLIPS PSPS RESTRUCTURING

EQUIPMENT

1	APPLICABLE TO	<input checked="" type="radio"/> INQUIRY <i>ent</i>	<input type="radio"/> PURCHASE	<input type="radio"/> RECORD
2	SERVICE	AXIAL FLOW PROPELLER TYPE ELBOW PUMP DRIVER <i>Package</i>	DIVISION	UNIT
3	LOCATION	PASADENA, TEXAS		
4	MANUFACTURER	<i>LAWRENCE PUMPS, INC</i>	TYPE	<i>9500 SERIES</i>
5	DESIGN HP/SPEED		FLOW CAPACITY	14,500 GPM
6	DRIVER	ELECTRIC INDUCTION MOTOR		

INSTRUCTIONS TO BIDDERS/VENDORS

7	1. BIDDER/VENDOR SHALL COMPLETE APPLICABLE AREAS OF THIS DATA SHEET.
8	2. SOUND PRESSURE LEVELS (SPL) IN DECIBELS (REFERENCE TO MICRO-PASCAL) SHALL BE MEASURED 3FT (1M) FROM MAJOR BOUNDING SURFACES, EXCLUDING
9	MINOR PROJECTIONS SUCH AS CONDUIT BOXES AND BEARING HOUSINGS, AT 5 FEET ABOVE GRADE OR PLATFORM UNLESS OTHERWISE STATED AS FOLLOWS:
10	
11	3. MEASUREMENTS SHALL BE MADE FOLLOWING THE STANDARDS OF ANSI S1.13, "METHODS FOR THE MEASUREMENT OF SOUND PRESSURE LEVELS," LATEST ADDITION.
12	4. SPL ARE TO BE MEASURED DURING NORMAL OPERATION at: <input type="radio"/> FULL LOAD <input type="radio"/> 50% LOAD <input type="radio"/> 125% LOAD <input checked="" type="radio"/> NO LOAD; <i>Data then compared to historical data to determine estimated noise level in field (as represented below).</i>
13	5. WHERE EQUIPMENT NOISE HAS PROMINENT OR AUDIBLE DISCRETE TONES IN A NARROW FREQUENCY BAND LESS THAN ONE OCTAVE BAND WIDE, THE
14	ALLOWABLE SPL FOR THE OCTAVE BAND CONTAINING THE DISCRETE TONE SHALL BE REDUCED AS FOLLOWS:
15	63 Hz THROUGH 125 Hz - NONE
16	250 Hz THROUGH 500 Hz - 5dB
17	1,000 Hz - 6dB
18	2,000 Hz - 7dB
19	4,000 Hz THROUGH 8,000 Hz - 8dB
20	PROMINENT DISCRETE TONES, AS USED HERE, ARE DEFINED AS THOSE HAVING A SOUND PRESSURE LEVEL WHICH, WHEN MEASURED IN A ONE-THIRD OCTAVE
21	BAND EXCEEDS THE ARITHMETIC AVERAGE OF THE SOUND PRESSURE LEVELS OF THE TWO ADJACENT ONE-THIRD OCTAVE BANDS BY 5dB

EQUIPMENT NOISE DATA

SOUND PRESSURE LEVELS							
OCTAVE BAND CENTER FREQ. Hz	MAX ALLOWABLE NOISE LEVEL dB	STANDARD EQUIPMENT NOISE LEVEL		SPECIAL DESIGN NOISE LEVEL		ACOUSTIC TREATMENT NOISE LEVEL	
		ANTICIPATED/ dB Typ.	GUARANTEED dB	ANTICIPATED dB	GUARANTEED dB	ANTICIPATED dB	GUARANTEED dB
26	63	52.4					
27	125	58.1					
28	250	66.8					
29	500	81.9					
30	1,000	82.7					
31	2,000	82.6					
32	4,000	71.7					
33	8,000	61.8					
34	dBA @ 3	83.8	≤ 85				

☐ THIS INFORMATION WILL NOT ALWAYS BE PROVIDED HOWEVER, THE BIDDER/VENDOR SHALL ALWAYS INDICATE THE ANTICIPATED AND GUARANTEED NOISE LEVELS

NOISE DESCRIPTION

39	(CHECK ALL THAT APPLY)
40	<input checked="" type="radio"/> CONTINUOUS <input type="radio"/> INTERMITTENT <input type="radio"/> IMPACT <input type="radio"/> BROAD BAND <input type="radio"/> NARROW BAND NOISE EXIST
41	<input type="radio"/> DIRECTIONAL <input type="radio"/> NON-DIRECTIONAL
42	<input type="radio"/> DESCRIBE SPECIAL DESIGN ADDED COST \$
43	<input checked="" type="radio"/> DESCRIBE ACOUSTIC TREAT. ADDED COST \$
44	

GUARANTEE

45	A NOISE TEST MAY BE PERFORMED AFTER THE STARTUP OF THE EQUIPMENT COVERED BY THIS SPECIFICATION. ANY TEST WILL BE PERFORMED BY
46	JACOBS ENGINEERING GROUP AND WITNESSED BY THE OWNER AND BY JACOBS ENGINEERING GROUP FOR RECORD ONLY. NOISE LEVEL GUARANTEES ARE REQUIRED
47	FROM THE PUMP MANUFACTURER AND PACKAGER.
48	VENDOR SHALL ESTIMATE NOISE LEVEL AT EACH OCTAVE BAND FOR THE PACKAGE AND SUBMIT TO JACOBS FOR REVIEW AND APPROVAL.
49	
50	
51	

JACOBS P.O. 58-BK6560-HH000583

ITEM # 67-5095

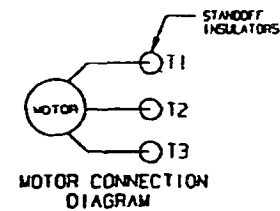
RL2 REACTOR CIRCULATION
PUMP

SAP # 10533692

JACOBS ENGINEERING GROUP INC - CENTRAL REGION		
PROJECT NO. 58-BK6560	P.O. NO. HH000583	SERIAL NO.
SIGNATURE <i>[Signature]</i>	DATE 1/21/06	ITEM NO. 67-5095
REVISIONS 1. 1/21/06		SUSPENSE DATE 2-1-2006
D. C. UNACCEPTABLE - DO NOT PROCEED WITH FABRICATION D. R. FOR INFORMATION ONLY Release of this drawing by Jacobs Engineering Group does not release the supplier of his responsibility to supply the materials in accordance with the procurement documents.		

15 - 240 7760145 00
CITY OF NEW YORK

- MOTOR DATA:
ROTOR END FLOAT .
END FLOAT OF LID IN COAT OIL = .19"
OIL CAPACITY PER BEARING: 1.7 OF DRIVE END, 1.8 OF NON-DRIVE END.
USE A HIGH QUALITY RUNNING OIL HAVING A VISCOSITY
OF 300 TO 350 SUS @ 100°F (150 VG 60)
FOR ALIGNMENT REQUIREMENTS SEE THE INSTRUCTION BOOK.



JACOBS ENGINEERING GROUP INC - CENTRAL REGION		
PROJECT NO. S-816-K	P.O. # 583	SERIAL NO.
DATE RECEIVED <u>12/10/06</u>		ITEM NO. <u>07-5095</u>
FROM AND TO COMMENTS BY D. C. URACE/FACIGATION		SUSPENSE DATE <u>2/1/2006</u>
<p><input type="checkbox"/> D. C. URACE/ENGINEERING REVERSE, RESUBMIT, PROCEED WITH FABRICATION</p> <p><input checked="" type="checkbox"/> D. C. URACE/FABRICATION - DO NOT PROCEED WITH FABRICATION</p> <p><input type="checkbox"/> D. C. FORD/CORROSION PREVENTION</p>		
Reason for time drawing by Jacobs Engineering Group does not reduce the magnitude of its responsibility to supply the materials in accordance with the procurement documents.		

JS Size	W	0750 U-Dimension	Thread	Lagging	H Shank	I Type	260 Bore	C Material	Cap & Chain	Facing	Rating	Special Lagging Length
Code	inches	Code	inches	Code	inches	Code	Type	Code	Type	Code	Rating #	
50	1/2	0162	1 1/2	-	Without	T	NPT Thd.	AA	Brass	F	150	150
75	3/4	0250	2 1/4	L	With	W	Weld-in	B	Carbon Steel	R	300	300
10	1	0450	4 1/2			F	Flanged	C	AISI 304	J	600	600
12	1 1/4	0750	7 1/4			V	Van Stone	S	AISI 316	L	1500	1500
15	1 1/2	1050	10 1/2			S	Socket Weld				2500	2500
20	2	1350	13 1/2			M	Limited Space Threaded					
30	3	1650	16 1/2			G	Ground Joint					
40	4	1950	19 1/2			C	Sanitary					
		2250	22 1/2									
Code	Internal Thread	Code	Shank	Code	Diameter	Code	Material	Code	Facing			
-	1/2 NPSM	H	Tapered	260	.260"	1	Brass	F	Flat Face			
		S	Straight	385	.385"	2	Stainless Steel	R	Raised Face			
		R	Stepped					J	Ring Joint			
		B	Built-up					L	Lap Joint			

Type: Straight (Uniform) Shank, Threaded

Bore Size: .385

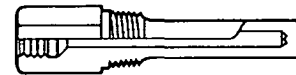
Process Conn.: 1/2, 3/4, 1 NPT, Weld-in

Materials: Brass, Carbon Steel

304 Stainless Steel, 316 Stainless Steel



Standard Configuration



Lagging Configuration

Type: Stepped Shank, Threaded

Bore Size: .260

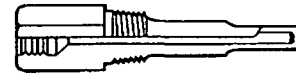
Process Conn.: 1/2, 3/4, 1 NPT

Materials: Brass, Carbon Steel

304 Stainless Steel, 316 Stainless Steel



Standard Configuration



Lagging Configuration

Type: Tapered Shank, Threaded

Bore Size: .260, .385

Process Conn.: 1/2, 3/4, 1 NPT

Materials: Brass, Carbon Steel

304 Stainless Steel, 316 Stainless Steel



Standard Configuration



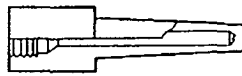
Lagging Configuration

Type: Socket Weld

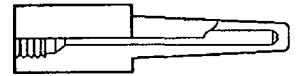
Bore Size: .260, .385

Process Conn.: 3/4, 1" Pipe Size

Materials: 304 Stainless Steel, 316 Stainless Steel, Carbon Steel



Standard Configuration



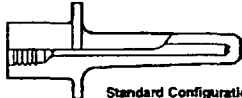
Lagging Configuration

Type: Van Stone

Bore Size: .260, .385

Process Conn.: 1, 1 1/4" Pipe Size

Materials: 304 Stainless Steel, 316 Stainless Steel



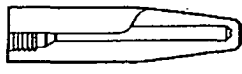
Standard Configuration

Type: Weld-in

Bore Size: .260, .385

Process Conn.: 1 1/4" Dia.

Materials: 304 Stainless Steel, 316 Stainless Steel



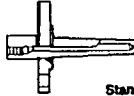
Standard Configuration

Type: Flanged

Bore Size: .260, .385

Process Conn.: 1, 1 1/2, 2" Pipe Size

Materials: 304 Stainless Steel, 316 Stainless Steel



Standard Configuration

Type: Sanitary

Bore Size: .260, .385

Process Conn.: Tri-Clamp connection® 1, 1 1/2, 2"

Materials: 304 Stainless Steel, 316 Stainless Steel



Standard Configuration



Lagging Configuration

Consult factory for guidance in product selection
 Phone (203) 385-0217, Fax (203) 385-0602 or
 visit our web site at www.ashcroft.com

MADE IN U.S.A.

DRESSER
 Instruments

Series 4000 Ball Valves

To use this CONFIGURATOR, please make all selections from the PULL DOWN MENUS to build the part number required.

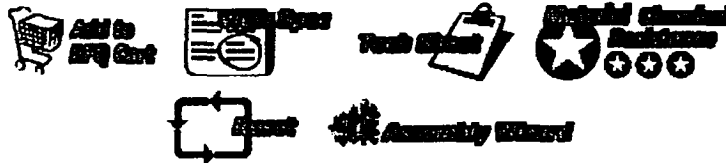
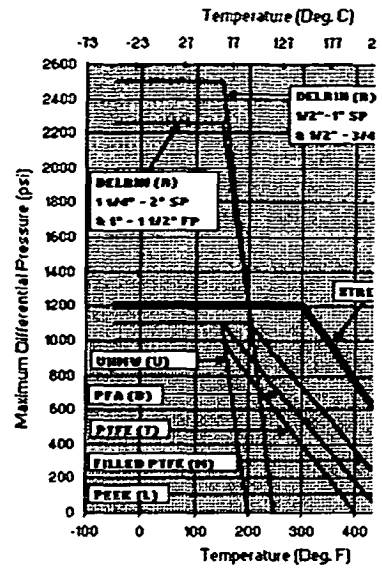
[Click Here For Standard Configuration](#)

3/4	4P			36	00	XT	2
Size	Style	Type	Special	Body	Ball/Stem	Seat/Seal	Fasteners
Size:	3/4" (20mm)						
Style:	Full port butt weld (Sched. 80)						
Type:							
Special:							
Body:	316 Stainless Steel						
Ball/Stem:	Same as body						
Seat/Seal:	Xtreme™/TFM & Graphite Seal*						
Fasteners:	ASTM A193 Gr B8 Bolts/ASTM A194 Gr 8,8C,8M or 8F N						

Pressure rating is critical, please refer to Tech Sheet as pressure ratings are dependent on pressure class, port configuration, and valve size.

*Typical for general service.

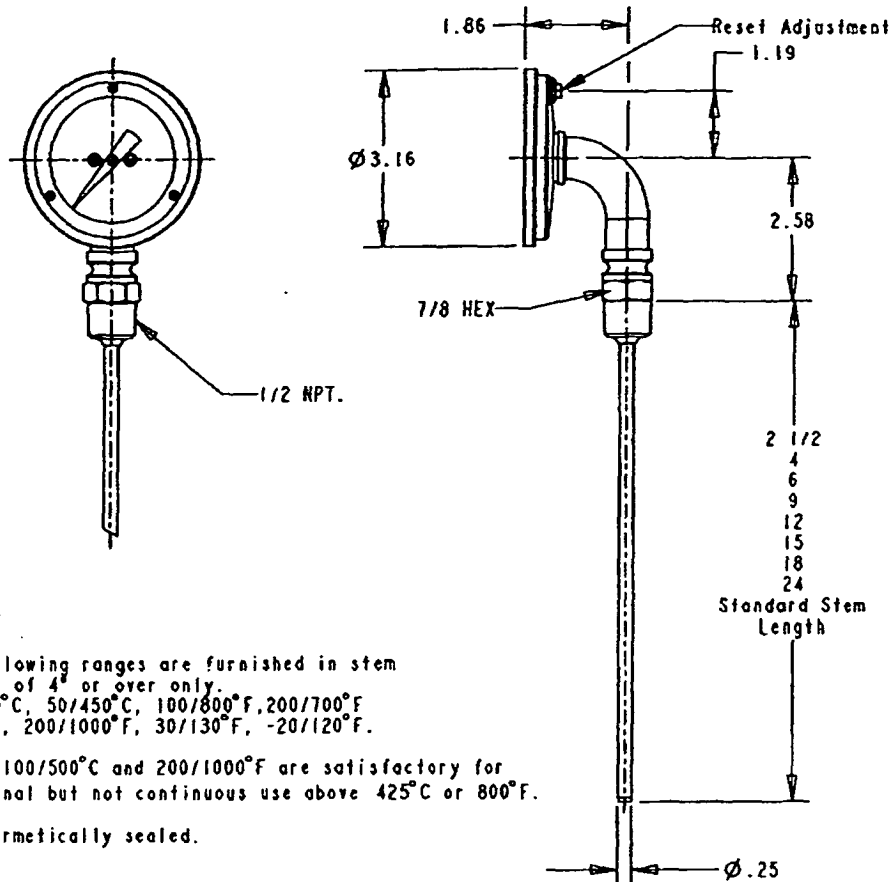
SEAT RATINGS ONLY



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**DRESSER
INDUSTRIES**

250 EAST MAIN STREET
STRATFORD CT. 06497



Note-1
The following ranges are furnished in stem lengths of 4" or over only.
100/500°C, 50/450°C, 100/800°F, 200/700°F
0/100°F, 200/1000°F, 30/130°F, -20/120°F.

Note-2
Ranges 100/500°C and 200/1000°F are satisfactory for occasional but not continuous use above 425°C or 800°F.

Note-3
Unit hermetically sealed.

A	7565	Redesigned and redrawn on PRO-E.	LPD	03-25-96
Rev	C/N	Description	By	Date
Ltr	No.			

This print certified correct for		General Dimension	
Customers Name		30 E160L Hermetically Sealed Bimetal Dial Thermometer	
Customers Order No.	Drawn: LPD	Date 03-25-96	Rev. Let. A
Dresser Order No.	Checked: LPD	Date 4-3-96	Date of issue
Certified By	Date	Approved: J.T.	70A868

Bimetal Thermometers
Series EI, ASME B40.3
Grade A ($\pm 1\%$ of span)

Selection Table

Case Size		Style	Stem				Stem Lengths		Temperature Range			
Dial	Code		Connection	Code	Location	Code	"S" Length (inches)	Code	°F* Fahrenheit	°/Div.	Fig. Inter.	° Cel
2"	20	EI	Plain	40	Rear	R			-80/120	2	20	-50
			Pointed Plain	50	Rear	R	2.5	025	-20/120††			-20
			.25 NPT	60	Rear	R	4	040	30/130††	1	10	0/5
3"	30		.5 NPT Union	42	Everyangle	E	6	060	0/200	2	20	0/
			.5 NPT	60			9	090	0/250			10/
5"	50		.5 NPT	60	Rear	R	12	120	50/300			5
					Lower	L	15	150	50/400	0/		
			.5 NPT Union	42	Everyangle	E	18	180	50/550	50/4		
			.5 NPT	60			24	240	200/700†	100/5		
			.5 NPT	60	Rear	R			100/800†	10	100	
					Lower	L			200/1000**†			

* Dual scale ranges available for all standard °F ranges (3" and 5" case only)

** Satisfactory for continuous service up to 800°F or 425°C. Can be used for intermittent service from 800 to 500°C. Use Ashcroft Duratemp thermometers for ranges above and below those listed above.

† Minimum stem length for these ranges is 4".

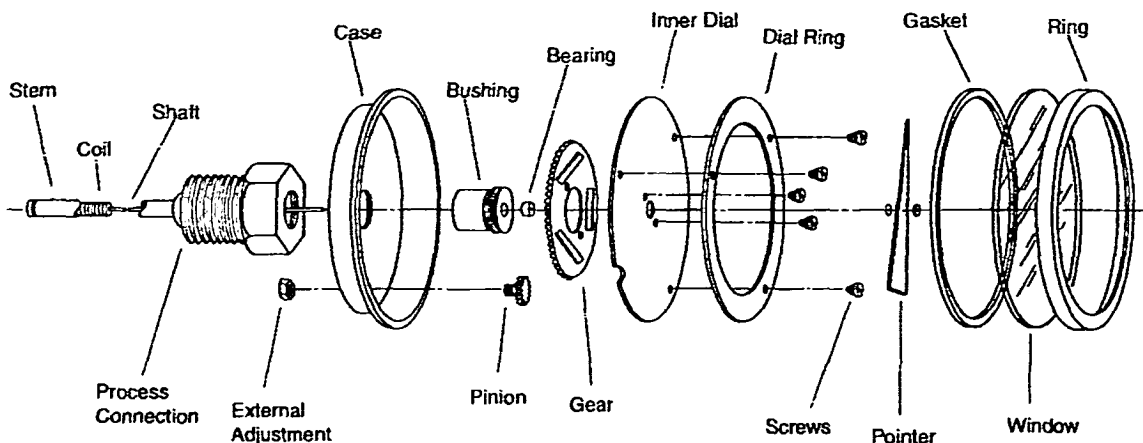
†† Minimum stem length for lower connection and Everyangle is 4".

Thermowells must be used on all pressure or velocity applications, to protect the stem of thermometer from damage, and to facilitate removal of the thermometer without disturbing the process. Maximum ambient temperature.

Overtemperature Limits

Top of Range °F	Maximum Overtemperature
up to 250	100% of span
250/550	50% of span
550/1000	800°F **

A13-01



Warning: When selecting all bimetal thermometers, consider the media and the ambient operating conditions. Improper application can be detrimental to the thermometer and can cause failure and possibly personal injury or property damage. Inaccuracies resulting from improper setting of the external adjustment by the user may cause personal injury or property damage. Consult ASME B40.3 for guidance in selection and use of bimetal thermometers.

Temperature Ranges: Standard Fahrenheit and Celsius ranges have been established to encompass all normal temperature measurement requirements. A bimetal thermometer can be used at an operating temperature anywhere throughout its dial range. Provision should be made for extreme temperature conditions. No bimetal thermometer should be exposed continuously to process temperatures over 800°F (425°C).

Operating Conditions: The maximum ambient temperature of the case should be no more than 200°F (95°C); liquid-filled series 150°F (65°C). Temperatures beyond this value may cause discoloration of the dial or result in increased pressure inside the casing which would ultimately lead to failure of the window. The lowest ambient temperature should not exceed -40°F (-40°C).

Thermowells: Thermowells must be used on any application where the stem of the bimetal thermometer may be exposed to pressure, corrosive fluids or high velocity. Additionally, the use of a thermowell permits instrument interchange or calibration check without disturbing or closing down the process.

Pointers: The pointers are balanced to close tolerances, and the paint finishes are controlled to assure long-term stability under adverse ultraviolet conditions.

Cases: There are three case styles. The CI series has no adjustment but is hermetically sealed. The hermetic seal prevents

entry of moisture into the casing, minimizing the possibility of icing or logging inside the case. The EL series provides the same features as the EI plus the added benefit of liquid filling which prolongs instrument life. Potential wear problems caused by excessive vibration are minimized through dampening, and the liquid medium improves readability. The instruments are leak-tested to ensure the integrity of the joints. Case and stem material is 304 stainless steel.

Coils: The bimetallic coils are carefully wound and inspected. Each is heat treated for optimum stability and overtemperature capability.

Bearings: The bearings are made of Teflon or other low-friction material.

Shafts: Shafts are made of specially drawn stainless steel wire with a very smooth finish.

Dials: The dials are based on computer-calculated temperature deflection data and have the Maxivision® format to minimize parallax error.

Windows: The standard window on EI and CI series are heavy-duty glass. Plastic and shatterproof glass are optional. The standard window on EL series is polycarbonate. No other options are available.

The complete line of Ashcroft industrial bimetal thermometers and accessories provides quality choices for your temperature applications. There is a long history of superior quality in engineering, manufacturing and customer service of these products. Each Ashcroft industrial bimetal thermometer is backed by a limited five year warranty.

Each instrument is manufactured to a standard accuracy of 1% of span (ASME B40.3, Grade A) traceable to the National Institute of Standards and Technology (NIST). The bimetal coils are heat treated for stability and overtemperature capability. A single helix is used to reduce lag time. The bearings are made of a low-friction long-life material. The shafts are made of

specially drawn stainless steel with a very smooth finish. All joints are welded, and the weld between the stem and the outlet is located at the bottom of the threads to eliminate the possibility of crevice corrosion.

Silicone dampening is included for improved vibration resistance. The Ashcroft Maxivision® dial eliminates parallax error by placing the pointer in the same plane as the graduations. The dial can be rotated 360 degrees and can be angled 180 degrees with the Everyangle™ connection.

Everyangle – Case Connection: The Ashcroft Everyangle Industrial bimetal thermometer dial face with Maxivision dial can be rotated 360 degrees and angled 180 degrees. It is available in the EI and EL (5" only in EL) series with either a threaded or compression type union connection.

This design provides maximum utility. Since the entire case can be rotated and angled, the instrument can be installed almost anywhere and adjusted so that the dial face can be easily read.

Consult factory for guidance in product selection
Phone (203) 385-0217, Fax (203) 385-0602 or
visit our web site at www.ashcroft.com

DRESSER
Instruments

A13-02

ASME B40.3* STANDARD ACCURACIES:
Example #1: Range 0/250°F Grade A

Span = 250-0 = 250°F

 Accuracy at 20% of span (50°F) = $\pm 1\%$ = $\pm 2.5^\circ\text{F}$

 Accuracy at 50% of span (125°F) = $\pm 1\%$ = $\pm 2.5^\circ\text{F}$

 Accuracy at 100% of span (250°F) = $\pm 1\%$ = $\pm 2.5^\circ\text{F}$
Example #2: -40/160°F Grade E

Span = 160-(-40) = 200°F

 Accuracy at 20% of span (0°F) = $\pm 3.4\%$ = $\pm 6.8^\circ\text{F}$

 Accuracy at 50% of span (60°F) = $\pm 1\%$ = $\pm 2.0^\circ\text{F}$

 Accuracy at 100% of span (160°F) = $\pm 5\%$ = $\pm 10.0^\circ\text{F}$
Example #3: Range 50/300°F Grade AA

Span = 300-(-50) = 250°F

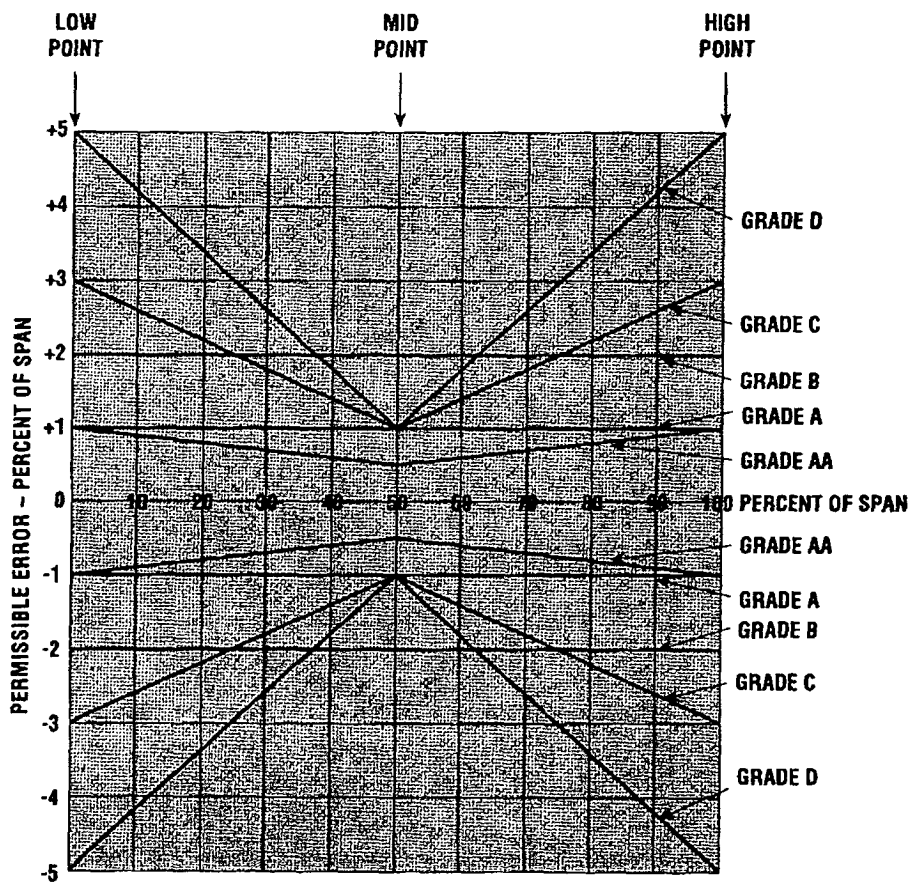
 Accuracy at 0% of span (50°F) = $\pm 1\%$ = $\pm 2.5^\circ\text{F}$

 Accuracy at 50% of span (175°F) = $\pm 0.5\%$ = $\pm 1.25^\circ\text{F}$

 Accuracy at 70% of span (225°F) = $\pm 0.7\%$ = $\pm 1.75^\circ\text{F}$
ACCURACY:

Thermometer accuracy is graded as shown in the table below. Adjustment of the case of a thermometer, with an adjustable angle connection, may affect its accuracy. This effect should not exceed 0.5% of span.

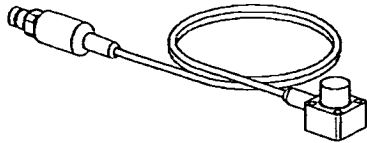
*ASME B40.3 may be ordered from:

 American Society of Mechanical Engineers
Three Park Avenue
New York, NY 10016


Specifications and Ordering Information
**350900 High Temperature Velocity
and Acceleration Sensor**



Description



The 350900 High Temperature Velocity and Acceleration Sensor (HTVAS) provides a continuous acceleration and velocity output, allowing the customer to protect their machine with an velocity signal while simultaneously capturing the acceleration signal for machinery diagnostics. It is primarily designed for use with the 3500/42M and 3500/44M monitors. When attached to the 3500/42M or 3500/44M monitors, the acceleration and velocity signals from one transducer must be used on a separate channel pair (such as channels 1 and 3) or separate monitors.

The 350900 High Temperature Velocity and Acceleration Sensor (HTVAS) separates the high-temperature sensing element from the signal conditioning electronics, with the two permanently connected via a hardline cable. This arrangement allows the sensing head to be mounted on surfaces with temperatures as high as +482 °C (+900 °F), while the signal conditioning electronics can be installed in a cooler location. By eliminating connections between the sensing head and its associated signal conditioning electronics, a significant source of potential transducer failures (connector problems) is eliminated. This achieves overall transducer system performance comparable to other case mounted vibration transducers, but permits use at significantly higher temperatures. The main features of the 350900 HTVAS are as follows:

- Velocity and acceleration output
- High temperature operation up to +482 °C (+900 °F)
- Electronics rated to +125 °C (+257 °F), survivable to +155 °C (+311 °F)

⚠ Caution

If housing measurements are being made for overall protection of the machine, thought should be given to the usefulness of the measurement for each application. Most common machine malfunctions (imbalance, misalignment, etc.) originate at the rotor and cause an increase (or at least a change) in rotor vibration. In order for any housing measurement alone to be effective for overall machine protection, a significant amount of rotor vibration must be faithfully transmitted to the bearing housing or machine casing, or more specifically, to the mounting location of the transducer.

In addition, care should be exercised in the physical installation of the transducer. Improper installation can result in a degradation of the transducer's performance, and/or the generation of signals which do not represent actual machine vibration.

Upon request, Bently Nevada can provide engineering services to determine the appropriateness of housing measurements for the machine in question and/or to provide installation assistance.



Specifications

Specifications are between +20 °C and +30 °C (+ 68 °F to + 86 °F) with machine casing vibration at 100 Hz (6000 cpm) and with a 10 k Ω load unless otherwise indicated.

Electrical

Power requirements:

<i>Input Voltage:</i>	-18 to -30 Vdc; -18 to -28 Vdc for hazardous area approval options.
<i>Quiescent Current:</i>	6 mA nominal, no load.
<i>Transverse sensitivity:</i>	Less than 5% of axial sensitivity.
<i>Amplitude linearity:</i>	$\pm 1\%$ to 4900 m/s ² (500 g) peak overall acceleration.
<i>Mounted Resonant Frequency:</i>	Greater than 15 kHz.
<i>Maximum cable length:</i>	305 metres (1000 ft).
<i>Grounding:</i>	Case isolated.

Velocity Output:

<i>Sensitivity:</i>	3.94 mV/mm/s (100 mV/in/s) $\pm 5\%$.
<i>Frequency Response:</i>	18 Hz to 1 kHz (1080 cpm to 60 kcpm) $\pm 5\%$ with 305 metres (1000 ft) of cable. 10 Hz to 2 kHz (600 cpm to 120 kcpm) ± 3 dB with 305 metres (1000 ft) of cable.
<i>System Sensitivity over Extended Temperatures:</i>	Over a sensor temperature range of -54 °C to +399 °C (-65 °F to +750 °F) and with the electronics between -54 °C to +125 °C (-65 °F to +257 °F), the output remains within $\pm 10\%$ of 3.94 mV/mm/s (100 mV/in/s). Over a sensor temperature range of -54 °C to +482 °C (-65 °F to +900 °F) and with the electronics between -54 °C to +125 °C (-65 °F to +257 °F), the output remains within $\pm 15\%$ of 3.94 mV/mm/s (100 mV/in/s).

<i>Output Bias Voltage:</i>	-10.0 \pm 2.0 Vdc.
<i>Velocity range:</i>	1270 mm/s (50 in/s).
<i>Broadband Noise Floor (5 Hz to 2 kHz):</i>	0.05 mm/s rms (0.002 in/s rms), max.

Acceleration Output:

<i>Sensitivity:</i>	1.02 mV/m/s ² (10 mV/g) $\pm 5\%$.
<i>Frequency Response:</i>	13 Hz to 4 kHz (780 cpm to 240 kcpm) $\pm 5\%$ with 305 metres (1000 ft) of cable. 5 Hz to 10 kHz (300 cpm to 600 kcpm) ± 3 dB with 305 metres (1000 ft) of cable.
<i>System Sensitivity over Extended Temperatures:</i>	Over a sensor temperature range of -54 °C to +399 °C (-65 °F to +750 °F) and with the electronics between -54 °C to +125 °C (-65 °F to +257 °F), the output remains within $\pm 10\%$ of 1.02 mV/m/s ² (10 mV/g). Over a sensor temperature range of -54 °C to +482 °C (-65 °F to +900 °F) and with the electronics between -54 °C to +125 °C (-65 °F to +257 °F), the output remains within $\pm 15\%$ of 1.02 mV/m/s ² (10 mV/g).

<i>Output Bias Voltage:</i>	-10.0 \pm 2.0 Vdc.
<i>Acceleration range:</i>	4900 m/s ² (500 g).
<i>Broadband Noise Floor (5 Hz to 10 kHz):</i>	147 mm/s ² (1.5 mg) rms, max.

Hazardous Area Classification:

Multiple approvals for hazardous areas certified by Canadian Standards Association (CSA/NRTL/C) in North America and by LCIE/CENELEC in Europe.

CSA/NRTL / C:

Ex ia IAE ia for Class I Zone 0 IIC T4 or Division 1, Groups A, B, C, D; Class II, Division 1, Groups E, F G; and Class III, when installed with an approved zener barrier or galvanic isolator per BN drawing 167923.

Ex nL/AEx nL Class I Zone 2 IIC T4 or Division 2 when installed without barriers per BN drawing 167923. T4 @ Ta = 100 °C (212 °F).

EUROPEAN:

EEx ia IIC T4 for Zones 0, 1, and 2, Group IIC, EC certificate number LCIE 04 ATEX 6140 X, when installed with intrinsically safe zener barriers or galvanic isolators. T4 @ Ta = 100°C (212 °F).

EEx nL for Class I, Zone 2, Group IIC, EC certificate number LCIE 04 ATEX 6141 X.

Electromagnetic Compatibility

Electrostatic discharge: EN 61000-4-2, Criteria A.

Electrical fast transients: EN 61000-4-4, Criteria A.

Radiated Susceptibility: EN 61000-4-3, Criteria A.

Conducted Susceptibility: EN 61000-4-6, Criteria A.

Surge Capability: EN 61000-4-5, Criteria A.

Magnetic Field: EN 61000-4-8, Criteria A.

Environmental Limits

Operating and storage temperature:

Sensor: -54°C to +482°C (-65°F to +900°F).

Mineral Insulated Cable: -54°C to +482°C (-65°F to +900°F).

Electronics: -54°C to +125°C (-65°F to +257°F).

Soak Back Temperature: The electronics will survive temperature exposure of +155°C (+311°F) for four hours without failure. Electrical performance will not be met during this period.

Shock Survivability: 19,620 m/s² (2000 g) peak, maximum.

Relative humidity: 100% condensing, non-submerged. Case is hermetically sealed.

Physical

Sensor:

Dimensions: See Figure 1

Mounting: 30.2 mm (1.188 in) square mounting hole pattern, 7.2 mm (0.283 in) mounting holes (4 holes).

Mounting Surface: 32 microinch rms.

Material: 600 Inconel® steel.

Integral Cable:

Diameter: 6.35 ± 1.27 mm (0.25 ± 0.05 in)

Material: 300 Series Stainless Mineral Insulated Integral Cable with Stainless Steel Overbraid.

Bend Radius: Minimum bend radius of 51 mm (2.0 in).

Integral Electronics:

Dimensions: See Figure 1

Mounting: Patch panel hub mount.

Material: 300-series stainless steel.

Connector: MIL-DTL-83723/90 - 1006N with gold-plated 300-series stainless steel.

System Weight (without field wiring): 0.545 kg + 0.10 kg/m cable length (1.200 lb + 0.006 lb/in cable length), typical.

Mounting angle: Any orientation

Ordering Information

High Temperature Velocity and Acceleration Sensor

350900-AXXX

Option Descriptions:

<i>A: Integral Cable</i>	0 2 3	23 inches (0.58 metres)
<i>Length Option</i>	0 2 6	26 inches (0.66 metres)
	0 2 7	27 inches (0.69 metres)
	0 4 4	44 inches (1.12 metres)
	0 7 7	77 inches (1.96 metres)
	0 8 3	83 inches (2.11 metres)
	1 5 8	158 inches (4.00 metres)
	2 3 7	237 inches (6.00 metres)
	3 1 5	315 inches (8.00 metres)
	3 9 4	394 inches (10.0 metres)

350901-040 40 foot (12.2 metre) field interconnect cable.

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Dimensional drawing

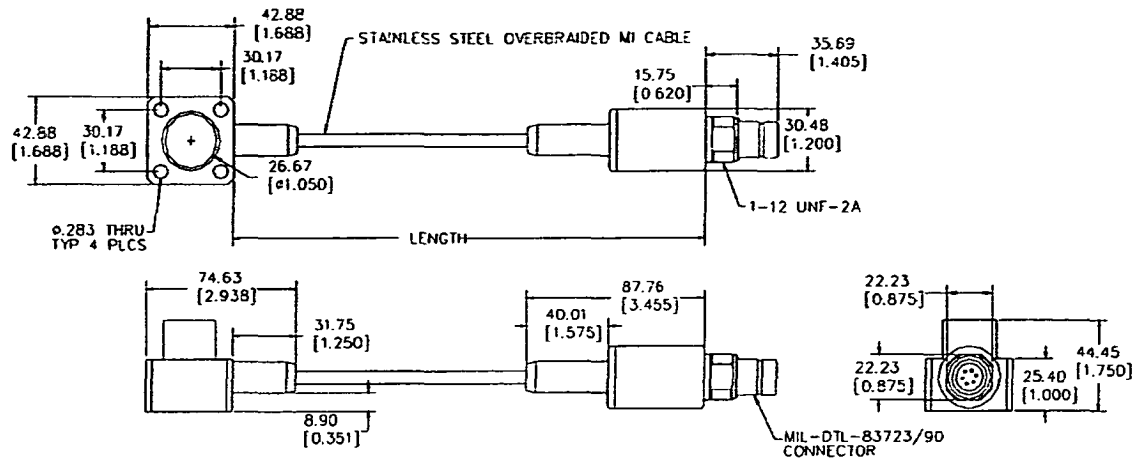


Figure 1: Transducer dimensional drawing
Dimensions are in millimetres (inches)

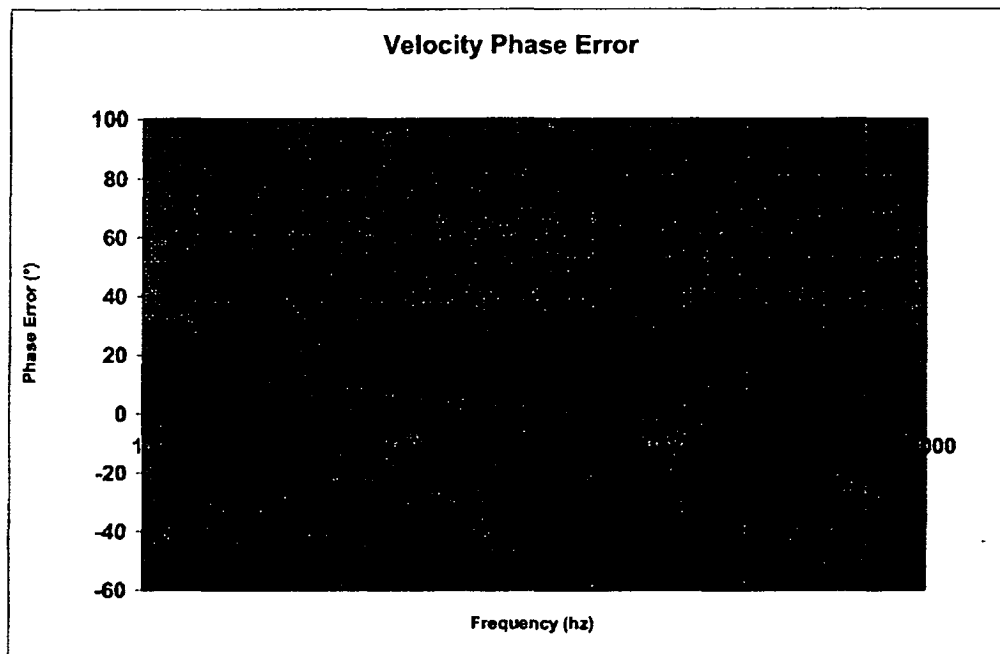
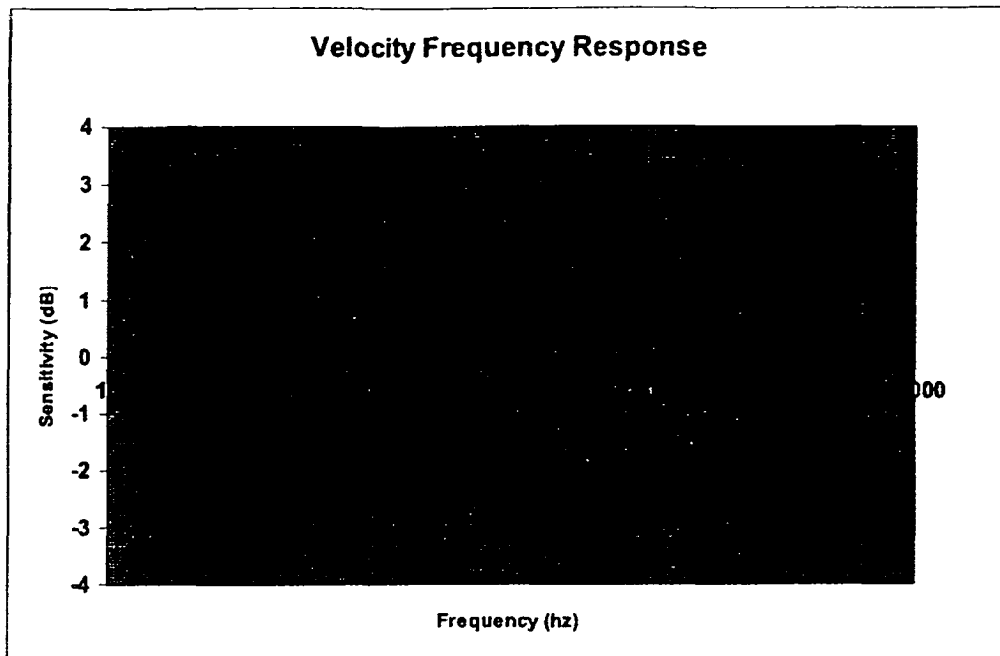


Figure 2: Velocity Amplitude and Phase Response

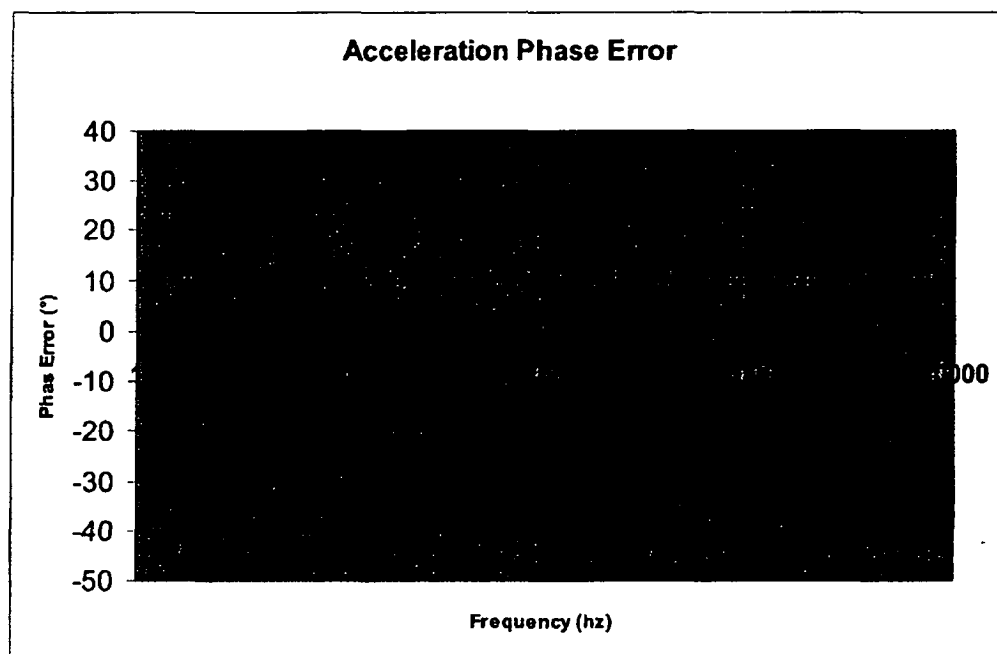
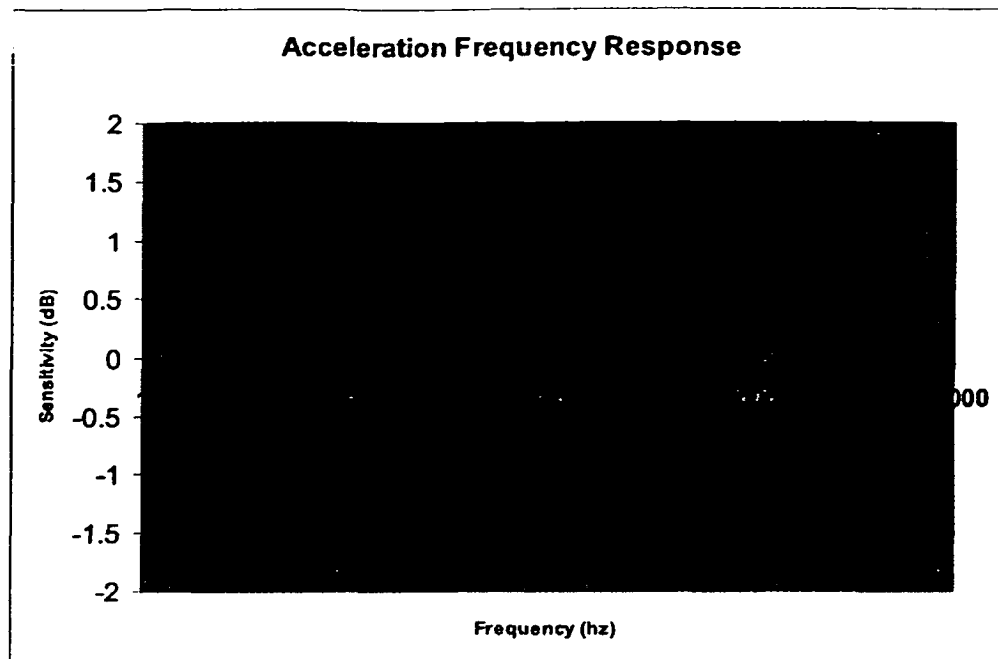


Figure 3: Acceleration Amplitude and Phase Response

IL 62.

16" LOOP REACTOR I

(92071)

CUSTOMER DESIGNATION	LPI DESIGNATION	DEVICE	FUNCTION/LOCATION	MANUFACTURER	MANUFACTURER'S PART NUMBER	NOTES	SETPOINTS
	BRV01	BLOCK/BLEED VALVE	PRIM. SEAL OIL RES INLET LINE (PSV 51007)	BY RESERVOIR MANUFACTURER			
	BRV02	BLOCK/BLEED VALVE	SAFETY SEAL OIL RES INLET LINE (PI52038)	BY RESERVOIR MANUFACTURER			
	BRV03	BLOCK/BLEED VALVE	SAFETY SEAL OIL RES INLET LINE (PT39518)	BY RESERVOIR MANUFACTURER			
	BRV04	BLOCK/BLEED VALVE	SAFETY SEAL RES FOR LT 55003	BY RESERVOIR MANUFACTURER			
	BRV05	BALL VALVE	PRIMARY SEAL OIL FEED LINE	NELES-JAMESBURY	3/4-40-3600XT-2	L.O.	
	BRV06	BALL VALVE	PRIMARY SEAL OIL RETURN LINE	NELES-JAMESBURY	3/4-40-3600XT-2	L.O.	
	BRV07	BALL VALVE	SAFETY SEAL OIL RES RETURN LINE	NELES-JAMESBURY	3/4-40-3600XT-2	L.O.	
	BRV08	BALL VALVE	SAFETY SEAL OIL SYSTEM DRAIN LINE	NELES-JAMESBURY	3/4-40-3600XT-2	N.C.	
	BRV09	BALL VALVE	PRIMARY SEAL OIL RES INLET LINE	NELES-JAMESBURY	3/4-40-3600XT-2	N.C.	
	BRV10	BALL VALVE	SAFETY SEAL OIL RES VENT LINE	NELES-JAMESBURY	3/4-40-3600XT-2	L.O.	
	BRV11	BALL VALVE	SAFETY SEAL OIL RES VENT LINE	NELES-JAMESBURY	3/4-40-3600XT-2	L.O.	
	GV01	GATE VALVE	SAFETY SEAL OIL RES VENT LINE	NELES-JAMESBURY	3/4-40-3600XT-2	L.O.	
	GV02	GATE VALVE	PRIMARY SEAL OIL RES VENT LINE	BY RESERVOIR MANUFACTURER		N.C.	
	GV03	GATE VALVE	SAFETY SEAL OIL RES DRAIN LINE	BY RESERVOIR MANUFACTURER		N.C.	
	GV04	GATE VALVE	PRIMARY SEAL VENT TO PI 52483	BY RESERVOIR MANUFACTURER		N.C.	
	LG 65005	LEVEL GAUGE	SAFETY SEAL OIL RES VENT LINE	BY RESERVOIR MANUFACTURER			
	L81 66487	LEVEL SWITCH LOW	PUMP BEARING FRAME	MAGNETROL	TDF-1000-V00		Indicator Only
	LT 52003	LEVEL TRANSMITTER	SAFETY SEAL OIL RES VENT LINE	BY RESERVOIR MANUFACTURER		WTEC-A110-002 PROBE	SET HH@95%, HQ@95%, L@20%, LL@95%
	PI 52038	PRESSURE INDICATOR	SAFETY SEAL OIL RES INLET LINE	BY RESERVOIR MANUFACTURER			Output for Customer Use
	PI 52483	PRESSURE INDICATOR	PRIMARY SEAL OIL RES INLET LINE	BY RESERVOIR MANUFACTURER			Indicator Only
	PSV 51005	PRESSURE SAFETY VALVE	SAFETY SEAL OIL RES VENT LINE	MERCER VALVE CO	81-130-2111312GO	3/4" INLET" Outlet	Open at 1000 psig
	PSV 51007	PRESSURE SAFETY VALVE	PRIMARY SEAL OIL RES VENT LINE	MERCER VALVE CO	81-130-2111312GO	3/4" INLET" Outlet	Open at 1000 psig
	PT 64515X	PRESSURE TRANSMITTER	SAFETY SEAL OIL RES INLET LINE	BY RESERVOIR MANUFACTURER			High SP: 30 psig above flareback press.
	RO 54073	RESTRICTION ORIFICE	SAFETY SEAL OIL RES VENT LINE				High-High SP: 100 psig above flareback press.
	RO 54055	RESTRICTION ORIFICE	SAFETY SEAL OIL RES VENT LINE				
	SD01	SPECTACLE DISC	PRIMARY SEAL OIL RES VENT LINE			LPI 317-00003-000	
	TE 57683A	TEMPERATURE ELEMENT (RTD)	MOTOR PHASE A #01	BY MOTOR MANUFACTURER		LPI 317-00003-000	
	TE 57683B	TEMPERATURE ELEMENT (RTD)	MOTOR PHASE A #02	BY MOTOR MANUFACTURER			Output for Customer Use
	TE 57683C	TEMPERATURE ELEMENT (RTD)	MOTOR PHASE B #01	BY MOTOR MANUFACTURER			Output for Customer Use
	TE 57683D	TEMPERATURE ELEMENT (RTD)	MOTOR PHASE B #02	BY MOTOR MANUFACTURER			Output for Customer Use
	TE 57683E	TEMPERATURE ELEMENT (RTD)	MOTOR PHASE C #01	BY MOTOR MANUFACTURER			Output for Customer Use
	TE 57683F	TEMPERATURE ELEMENT (RTD)	MOTOR PHASE C #02	BY MOTOR MANUFACTURER			Output for Customer Use
	TE 57683G	TEMPERATURE ELEMENT (RTD)	MOTOR BEARING, REAR	BY MOTOR MANUFACTURER			Output for Customer Use
	TE 57683H	TEMPERATURE ELEMENT (RTD)	MOTOR BEARING, FRONT	BY MOTOR MANUFACTURER			Output for Customer Use
	TE 57683I	TEMPERATURE ELEMENT (RTD)	PUMP THRUST BEARING	OMEGA	PR-12-3-100-174-8-E		Output for Customer Use
	TW 57045	THERMOWELL	PUMP THRUST BEARING OIL SUMP	ASHCROFT-DRESSER	10W0102SM260C		Output for Customer Use
	TE 57046	TEMPERATURE ELEMENT (RTD)	PRIMARY SEAL OIL RETURN LINE	OMEGA	PR-12-2-100-174-8-E		Output for Customer Use
	TW 57046	THERMOWELL	PRIMARY SEAL OIL RETURN LINE	ASHCROFT-DRESSER	10W0102SM260C		Output for Customer Use
	TE 57047	TEMPERATURE ELEMENT (RTD)	PRIMARY SEAL OIL FEED LINE	OMEGA	PR-12-2-100-174-8-E		Output for Customer Use
	TW 57047	THERMOWELL	PRIMARY SEAL OIL FEED LINE	ASHCROFT-DRESSER	10W0102SM260C		Output for Customer Use
	TI 57047	TEMPERATURE INDICATOR	PUMP THRUST BEARING OIL SUMP	ASHCROFT-DRESSER	30E44E025-XC3		Output for Customer Use
	V-213	PRIMARY SEAL OIL RESERVOIR	SEAL LUBRICATION	JOHN CRANE LEMCO		0250 F. & 20/20 C	Bi-Metallic Thermometer
	V-214	SAFETY SEAL OIL RESERVOIR	SEAL LUBRICATION	JOHN CRANE LEMCO		SUPPLIED BY CUSTOMER	
	VE 53084AX	VELOCITY ELEMENT	PUMP THRUST BEARING	BENTLY-NEVADA	330525-02		SET HH@ 12 in/s, HH@ 20 in/s
	VE 53084BX	VELOCITY ELEMENT	PUMP THRUST BEARING	BENTLY-NEVADA	330525-02		SET HH@ 12 in/s, HH@ 20 in/s
	VE 53084CX	VELOCITY ELEMENT	PUMP RADIAL BEARING	BENTLY-NEVADA	330525-02		SET HH@ 12 in/s, HH@ 20 in/s
	VE 53084DX	VELOCITY ELEMENT	PUMP RADIAL BEARING	BENTLY-NEVADA	330525-02		SET HH@ 12 in/s, HH@ 20 in/s

REV 0 BY: M. A. NEMIRROW DATE: 12/06/2004 FIRST ISSUE

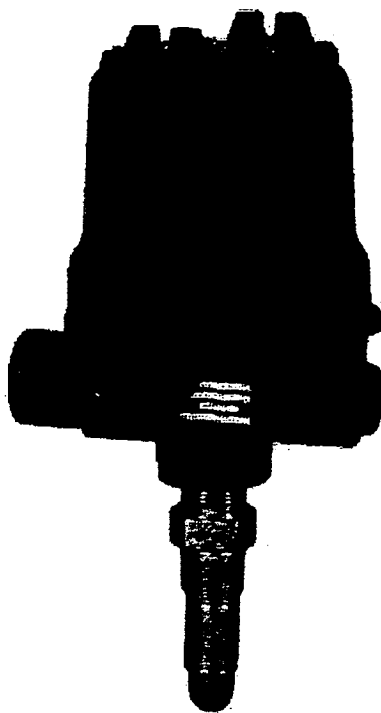
REV 1 BY: M. A. NEMIRROW DATE: 12/13/2004

REV 2 BY: M. A. NEMIRROW DATE: 2/12/2005

JACOBS P.O. 55-BK550-H000033
EQUIPMENT NO. 3: PUMP 57-4086; MOTOR 30-4086
SAP NO. 3: PUMP 10533692; MOTOR 10533693

Thermatel®

Installation and Operating Manual



Thermal Dispersion

Flow/Level Switch

Model TDF/TDL

Model TSF/TSL



Read this Manual Before Installing

This manual provides information on the Thermatel Thermal Dispersion Flow/Level Switch. It is important that all instructions are read carefully and followed in sequence. The *QuickStart Installation* instructions are a brief guide to the sequence of steps for experienced technicians to follow when installing the equipment. Detailed instructions are included in the *Complete Installation* section of this manual.

Conventions Used in this Manual

Certain conventions are used in this manual to convey specific types of information. General technical material, support data, and safety information are presented in narrative form. The following styles are used for notes, cautions, and warnings.

Notes

Notes contain information that augments or clarifies an operating step. Notes do not normally contain actions. They follow the procedural steps to which they refer.

Cautions

Cautions alert the technician to special conditions that could injure personnel, damage equipment, or reduce a component's mechanical integrity. Cautions are also used to alert the technician to unsafe practices or the need for special protective equipment or specific materials. In this manual, a caution box indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

Warnings

Warnings identify potentially dangerous situations or serious hazards. In this manual, a warning indicates an imminently hazardous situation which, if not avoided, could result in serious injury or death.

Safety Messages

The Thermatel system is rated by the IEC for use in Category II, Pollution Degree 2 installations. Follow all standard industry procedures for servicing electrical and computer equipment when working with or around high voltage. Always shut off the power supply before touching any components. Although high voltage is not present in this system, it may be present in other systems.

Electrical components are sensitive to electrostatic discharge. To prevent equipment damage, observe safety procedures when working with electrostatic sensitive components.

WARNING! Explosion hazard. Do not connect or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

Low Voltage Directive

For use in Category II installations. If equipment is used in a manner not specified by the manufacturer, protection provided by equipment may be impaired.

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Warranty

All Magnetrol/STI electronic level and flow controls are warranted free of defects in materials or workmanship for one full year from the date of original factory shipment. If returned within the warranty period; and, upon factory inspection of the control, the cause of the claim is determined to be covered under the warranty; then, Magnetrol/STI will repair or replace the control at no cost to the purchaser (or owner) other than transportation.

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The quality assurance system in place at Magnetrol/STI guarantees the highest level of quality throughout the company. Magnetrol/STI is committed to providing full customer satisfaction both in quality products and quality service.

Magnetrol's quality assurance system is registered to ISO 9001 affirming its commitment to known international quality standards providing the strongest assurance of product/service quality available.





Thermatel

Model TDF/TDL and TSF/TSL

Thermal Dispersion Flow/Level Switch

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Thermatel Flow/Level Switches use state-of-the-art thermal dispersion technology for gas flow and liquid flow/level monitoring and control. Flow/level detection is accomplished by sensing changes in the heat transfer characteristics of the media. The sensor is available in 316L stainless steel, Hastelloy C, or Monel welded construction with no moving parts. The easy to install and adjust units provide reliable, low maintenance performance in the most demanding applications.

The Thermatel Flow/Level Switch consists of a dual element sensing assembly mounted integrally to the electronics, or the sensor may be remote mounted up to 500 feet (150 meters) from the electronics.

Each element of the sensor is a miniature RTD (Resistance Temperature Detector). One element measures the temperature of the process at the sensor location, providing a reference temperature. The second RTD is self-heated to establish a temperature differential above the reference temperature. The cooling effect on the heated RTD, caused by the presence of flow or level, decreases the differential temperature between the two RTDs. This decrease in temperature differential is then converted to a relay actuation. The sensors are suitable for operation in temperatures of -100° F to +850° F (-73° C to +454° C).

Unpack the instrument carefully, making sure all components have been removed from the packing material. Inspect all components for damage, and report any concealed damage to the carrier within 24 hours.

Check the contents of the carton, making sure it agrees with the packing slip and the purchase order. Verify that the model number imprinted on the nameplate matches the number on the packing slip and the purchase order. Report any discrepancies to the factory. Check and record the serial number for future reference when ordering parts.

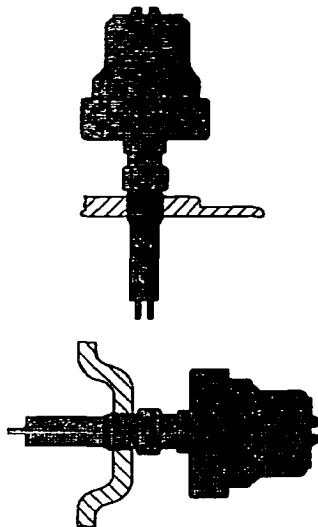


Figure 1

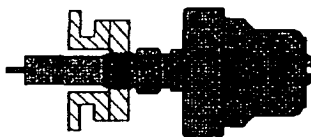


Figure 2

Unless ordered with factory calibration, the Thermatel switch is adjusted for a level switch between air and water. The set point of the unit must be adjusted for your application.

To calibrate for other applications, adjust the set point potentiometer, P1. Turning P1 clockwise decreases the sensitivity for use as a liquid flow switch. Turning P1 counterclockwise increases the sensitivity. Refer to Operation and Calibration section on page 5 for detailed procedure.

The gain adjustment is factory set to handle the majority of applications. However, there may be occasions when standard set point adjustment using P1 does not provide the desired performance. In these cases, adjust the gain potentiometer (P3) following the directions on page 7 (also refer to Probe Replacement and Gain Adjustment on Page 13).

2.3.1 Mounting Position and Location

Thermatel Flow/Level Switches should be located to allow easy access for service. Electronics should not be exposed to ambient temperature above +160° F (+71° C) or below -40° F (-40° C). Special precaution should be taken to prevent exposure to corrosive atmosphere, excessive vibration, shock or physical damage.

2.3.2 General Mounting Requirements

Thermatel Flow/Level Switches are shipped assembled to the sensor. Units may be mounted in any position or orientation. Refer to Figures 1 and 2.

Note: When installed in a nozzle, the sensor tips must clear the nozzle.

Note: All wiring, conduit and electrical fittings must conform to local electrical codes for the location selected.

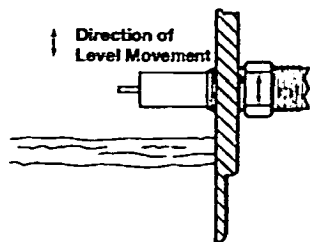


Figure 3C (Level)

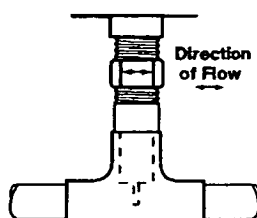


Figure 3A (Flow)

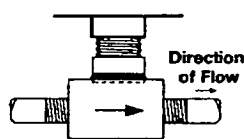


Figure 3B (Flow)

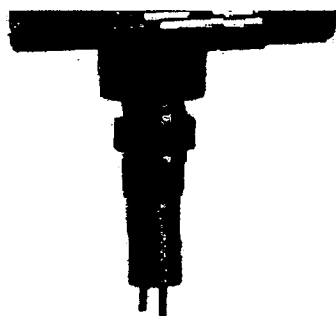


Figure 4

The Thermatel Flow/Level Switch has a standard $\frac{3}{4}$ " NPT mount designed for easy installation through a threaded port. Optional 1" NPT thread mount or mounting flanges are also available.

1. Apply thread sealant to the sensor and insert the sensor into the tee junction.

Caution: Tighten unit only at the wrench flats on the sensor using an open-end wrench. DO NOT use the instrument head to tighten the switch to the mounting port. Rotation of the instrument head with respect to the sensor assembly can cause internal wiring damage.

2. Tighten the sensor directly. DO NOT apply force to the switch housing when tightening the sensor.
3. Make sure the sensor is properly oriented to the flow (refer to Figures 3A and 3B) or level (refer to Figure 3C).

Caution: The switch body must be oriented so that the flow arrow is in the direction of the flow/level being detected. Proper orientation is marked on the wrench flats or on the top of the flange for reference. Refer to Figure 4.

Magnetrol's electronic instruments are manufactured to the highest quality standards. These instruments utilize electronic components which may be damaged by static electricity present in most work environments. The following steps are recommended to reduce the risk of component failure due to electrostatic discharge:

1. Ship and store circuit boards in anti-static bags. If an anti-static bag is not available, wrap board in aluminum foil. Do not place boards on foam packing materials.
2. Use a grounding wrist strap when installing and removing circuit boards. A grounded workstation is also recommended.
3. Handle printed circuit boards only by the edges. Do not touch components or connector pins.
4. Ensure that all electrical connections are completely made and none are partial or floating. Ground all equipment to a good, earth ground.

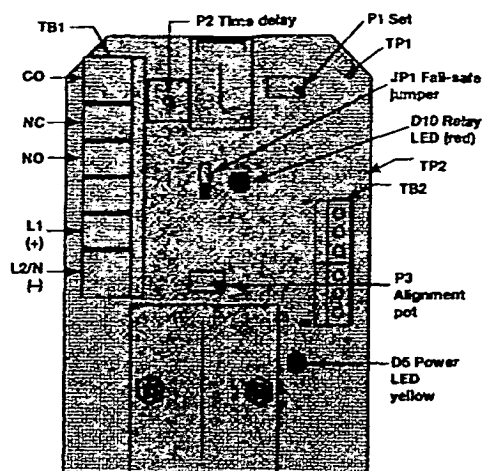


Figure 5A
TDF/TDL Electronics

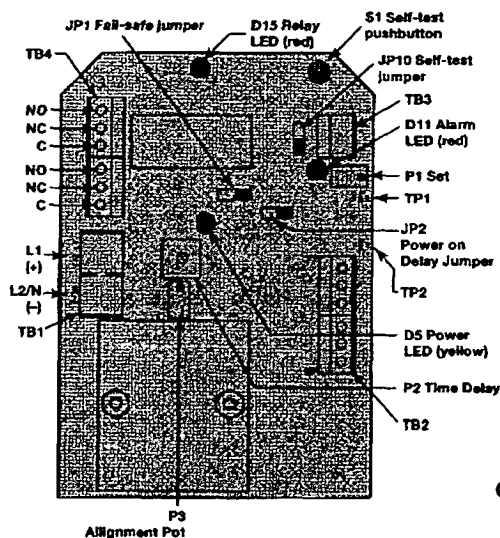


Figure 5B
TSF/TSL Electronics

All power and control connections are made at the terminal strip within the electronics enclosure. 12-24 AWG wire is recommended for power and control circuits.

OBSERVE ALL APPLICABLE ELECTRICAL CODES AND PROPER WIRING PROCEDURES.

1. Make sure the power source is turned off.
2. Unscrew and remove housing cover.
3. Pull power supply and control wires through conduit connection.
4. Connect power leads to proper terminals of the black terminal block. Refer to Figure 5A for TDF/TDL or 5B for TSF/TSL electronics.
 - a. 120 VAC - Connect "hot" wire to terminal marked L1 and the "neutral" wire to the terminal marked L2/N.
 - b. 240 VAC - Connect one wire to terminal marked L1 and the other wire to the terminal marked L2/N.
 - c. 24 VDC - Connect wires to terminals (+) and (-) on the black terminal block.

The green screw in the bottom of the housing should be used for grounding.

5. Perform Relay Connections (refer to Figure 5A for TDF/TDL or Figure 5B for TSF/TSL electronics).
6. Dress wiring to guard against interference or contact with cover or circuit board components.
7. Prevent moisture seepage into housing by installing an approved seal-drain fitting in the conduit run leading to the unit.
8. Set fail-safe jumper as described below.
9. Installation is complete. Replace housing cover.

Caution: In hazardous areas, do not power the unit until the conduit is sealed and enclosure cover is screwed down securely.

2.6.1 Relay Connections

Relay Connections and Maximum Ratings

TDF/TDL	SPDT	TB1	10 amp at 120 - 250 VAC 8 amp at 30 VDC 0.5 amp at 125 VDC
TSF/TSL	DPDT	TB4	10 amp at 120-250 VDC 8 amp at 28 VAC 0.5 amp at 125 VDC
	Hermetically sealed DPDT	TB4	5 amp at 120-250 VDC 5 amp at 28 VAC

The switch may be configured so that the relay either energizes or de-energizes when the set point is reached. Locating the fail-safe jumper (JP1) in the L position places the switch in a low level failsafe (LLFS) position. This causes the relay to energize when the set point is exceeded.

Locating the fail-safe jumper (JP1) in the H position places the switch in a high level fail-safe (HLFS) position. This causes the relay to de-energize when the set point is exceeded.

Refer to the following chart.

				NC to CO	NO to CO
On	High	HLFS	De-energized	Closed	Open
		LLFS	Energized	Open	Closed
On	Low	HLFS	Energized	Open	Closed
		LLFS	De-energized	Closed	Open
Fail	High	HLFS	De-energized	Closed	Open
		LLFS	De-Energized	Closed	Open
Fail	Low	HLFS	De-Energized	Closed	Open
		LLFS	De-energized	Closed	Open

2.6.2 Chart Notes and Definitions

- A. Equipment controlled by Thermatel relay is assumed to be powered from one source, while the Thermatel unit itself is assumed to be powered from a different source.
- B. "Fail" means a loss of power to the Thermatel unit.
- C. HLFS (High Level Fail-safe) means a flow rate or level which is equal to or above the adjusted set point.
- D. LLFS (Low Level Fail-safe) means a flow rate or level which is less than the adjusted set point.
- E. When the relay coil is de-energized, a connection is made between the terminals CO (common) and NC (normally closed), and there is no connection between CO and NO (normally open).
- F. When the relay coil is energized, a connection is made between the terminals CO and NO, and there is no connection between CO and NC.
- G. TDF/TDL – The red LED, D10, glows when the relay is energized.
- H. TSF/TSL – The red LED, D15, glows when the relay is energized. The alarm LED (D11) glows when a high flow or high level condition exists.

2.6.3 Remote Electronics Wiring

In remote electronics applications, the sensor and electronic circuit board are contained in separate housings. The sensor housing includes a 7-position terminal block for connecting a shielded 6-conductor cable. The cable's six conductors are connected to terminals 1 through 6 in the sensor housing. The cable shield is connected to the seventh terminal (Ground). Refer to Figure 6.

Remote electronics is recommended if the process temperature is greater than +250° F (+121° C) or when access to the electronics is limited.

The cable is routed to the electronic circuit board and connected to the green, 6-position terminal block (TB2). The cable's six conductors are connected to terminals 1 through 6. The cable shield should be connected to the green ground screw in the electronics housing base.

Note: The six conductors must be wired so that each terminal on the sensor terminal block TB2 (see Figure 5) is connected to its corresponding terminal on the electronic circuit board. Failure to do so will cause improper switch operation.

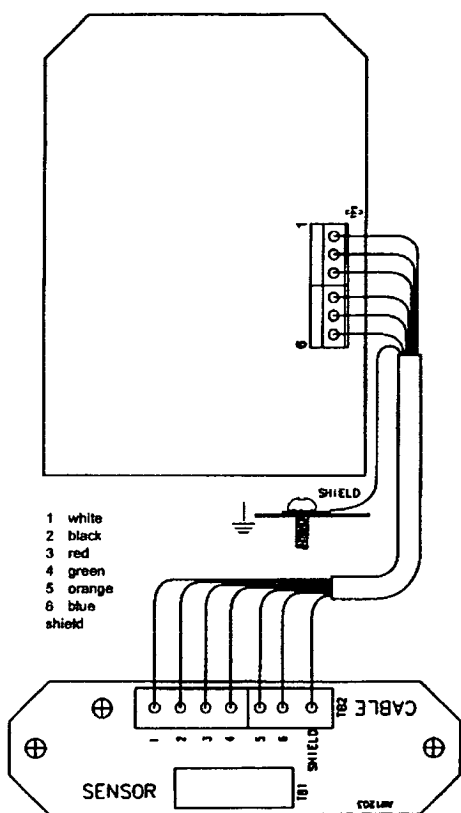


Figure 6

Note: Calibration should be performed using the actual fluid at the operating temperature.

Note: Potentiometer (P3) is set at the factory to handle most applications. The performance of the switch may be changed by adjusting P3:

1. Switch does not detect flow or level or response time is too long, turn P3 counterclockwise one turn and recalibrate;
2. Switch detects flow or level, but fails to reset for low flow/level, turn P3 clockwise one turn and recalibrate.

2.7.1 Flow Sensing Applications

Adjustment procedure FLOW/NO FLOW

1. Rotate P2 (time delay) fully counterclockwise (zero time delay).
2. Place JP1 (fail-safe) in the "L" position.
3. Reduce the flow rate to no flow. Allow 30 seconds for the sensor to stabilize.
4. Slowly rotate P1 counterclockwise until the red LED (D10 for the TDF/TDL or D11 for the TSF/TSL) illuminates.
5. Slowly rotate P1 clockwise until the red LED (D10 or D11) goes out.
6. Repeat steps 4 and 5 several times.
7. Slowly rotate P1 clockwise until the red LED (D10 or D11) goes out. Continue to rotate P1 clockwise another turn.
8. Resume flow.
9. If the response time required to sense no flow is too long, rotate P1 clockwise $\frac{1}{4}$ turn.
10. If the response time required to sense flow is too long, rotate P1 counterclockwise $\frac{1}{4}$ turn.
11. Repeat steps 11 and 12 until desired response times for flow and no flow are attained. Normal delays range from two seconds to over fifteen seconds, depending on the material and the flow rate.
12. If high level fail-safe operation is desired, move jumper, JP1, to the H position as described on page 4.

Adjustment procedure **VARIABLE FLOW RATE**

A. Adjust flow to desired switch point:

1. Rotate P2 (delay) fully counterclockwise.
2. Place JP1 (fail-safe) in the "L" position.
3. Establish the flow rate at the desired switching point.
Allow 30 seconds for the sensor to stabilize.
4. Slowly rotate P1 counterclockwise until the red LED (D10 for the TDF/TDL or D11 for the TSF/TSL) illuminates.
5. Slowly rotate P1 clockwise until the red LED goes out.
6. Repeat steps 4 and 5 several times.
7. If the red LED (D10 or D11) is illuminated, very slowly rotate P1 (set) clockwise until the red LED (D10 or D11) goes out.
8. a. Switch on decreasing flow: The set point is now at the actual flow rate. Increase the flow rate to normal operating conditions (the relay will change state). When the flow rate drops to the desired switching level, the relay will change state.
b. Switch on increasing flow: Slowly rotate P1 (set) clockwise until the red LED (D10 or D11) illuminates. The set point is now at the actual flow rate. Decrease the flow to normal operating conditions (the relay will change state). When the flow rate increases to the desired switching level, the relay will change state.

B. Maintain normal flow rate:

1. Rotate P2 (delay) fully counterclockwise.
2. Place JP1 (fail-safe) in the "L" position.
3. Maintain flow rate at normal operating conditions.
Allow 30 seconds for the sensor to stabilize.
4. Slowly rotate P1 counterclockwise until the red LED (D10 or D11) illuminates.
5. Slowly rotate P1 clockwise until the red LED goes out.
6. Repeat steps 4 and 5 several times.
7. If the red LED (D10 or D11) is illuminated, very slowly rotate P1 (set) clockwise until the red LED (D10 or D11) goes out.

-
8. If the flow can be reduced to the set point, follow procedure A; if it cannot be reduced, follow procedure B.
 - a. Switch on decreasing flow: Slowly rotate P1 (set) counterclockwise until the red LED (D10 or D11) illuminates. The set point is now just below the present flow rate. When the flow rate drops below the present flow rate, the relay will change state.
 - b. Switch on increasing flow: Slowly rotate P1 (set) clockwise until the red LED (D10 or D11) goes out. The set point is now just above the present flow rate. When the flow rate increases, the relay will change state.
 9. If high level fail-safe operation is desired, move the jumper to the "H" position, as described on page 4.

2.7.2 Level Sensing Applications

Adjustment procedure

1. Make sure that P2 (time delay) is fully counterclockwise (zero time delay).
2. Place JP1 (fail-safe) in the "L" position.
3. Submerge the sensor in still liquid. The liquid should have the same properties as the liquid being detected in the tank. If used for interface detection, put the sensor in the fluid with the highest thermal conductivity (typically water).
4. Slowly rotate P1 (set point) counterclockwise until the red LED (D10 on the TDF/TDL or D11 on the TSF/TSL) illuminates.
5. Slowly rotate P1 clockwise until D10 or D11 goes out.
6. Repeat steps 4 and 5 several times.
7. Ensure that LED D10 or D11 is illuminated.
8.
 - a. Low level alarm. Remove the sensor from the liquid. The alarm should indicate a dry condition in approximately 5 to 15 seconds depending upon application. If the response time to detect a dry condition is too long, rotate P1 clockwise $\frac{1}{2}$ turn and test again.
 - b. High level alarm. Remove the sensor from the liquid and allow for the red LED (D10 or D11) to turn on. Submerge the sensor in still liquid; the alarm should indicate in approximately three seconds. If the response time to detect liquid is too long, rotate P1 (set point) counterclockwise $\frac{1}{2}$ turn and test again.
9. If high level fail-safe operation is desired, move the jumper to the "H" position, as described on page 4.

2.7.3 Adjust Set Point

Following is a quick guide for adjusting the set point on Thermatel Flow/Level Switch.

Low flow	● off	—	OK
Low level	* on	—	↻ Turn P1 clockwise until LED is off.
High flow	● off	↻ Turn P1 clockwise until LED is on.	—
High level	* on	OK	—

NOTE: Jumper is in low level fail-safe (LLFS) position.

2.7.4 Time Delay

Adjusting P2 clockwise will increase the time delay between reaching the set point and energizing or de-energizing the relay. For fastest response, keep P2 in the full counterclockwise position.

2.7.5 Electronic Self-test – TSF/TSL Electronics Only

Jumper JP10 (refer to Figure 5B on page 4) permits the self-test to be performed in either a normal high flow/level or normal low flow/level condition. When jumper JP10 is placed in the “L” position, the self-test will simulate a low flow/level condition. With jumper JP10 in the “H” position, the self-test will simulate a high flow/level condition. If the switch is used in a normally high flow/level condition, put the jumper in the “L” position; if it is normally used in a low flow/level condition, put the jumper in the “H” position.

With power on and all connections made, press and hold the TEST button (S1). Refer to Figure 5B on page 4. For remote self-test, provide contact closure to two wires connected to TB3.

The red LED (D11), the relay LED (D15), and the relay will change state to confirm operation of the switch.

Release TEST button (S1) or remove contact closure for remote self-test. The switch will return to the initial condition.

Note: For units with time delay, output activation is after delay period.

2.7.6 Advanced Calibration Procedure

Measure and record the voltage between TP1 and TP2. This voltage will change with set point and may be used for future reference or adjustment of set point.

2.7.7 Power On Delay

The TSF/TSL switch incorporates a "Power On Delay." When power to the switch is first applied, there is no temperature difference between the two sensors, causing a high flow or high level alarm. The "Power On Delay" forces the relay to the fail-safe condition, avoiding a false high level or high flow condition during the warm up period. The power on delay may be set for 12 or 50 seconds or disabled.

Jumper JP2 sets the "Power On Delay" time. Refer to figure 5B on Page 4. With the jumper in the 12 position, the initial power on delay will be approximately 12 seconds. With the jumper in the 0 position, the power on delay is disabled. When the jumper is removed, the power on delay will be approximately 50 seconds. The operating yellow LED (D6) glows after power on delay has timed out.

3.1.1 Cleaning

The probe may be cleaned by soaking, spraying solvents or detergent and water onto the sensor tubes, or by ultrasonic cleaning.

Lime deposits may be safely removed by soaking in 20% hydrochloric acid. Warming to +150° F is permissible to speed this process.

For unusual cleaning problems, contact the factory and determine the exact materials of construction and chemical compatibility before using strong acids or unusual cleansers.

3.1.2 Probe Replacement – Integral Housing

Removal of probe

1. Make sure the power source is turned off.
2. Unscrew and remove housing cover.
3. Loosen the screws on the six position terminal block (TB2) to remove the four leads from the probe.
4. Unscrew probe from enclosure.

Installation of replacement probe (Refer to Figure 5 on page 4.)

1. The probe's leads have been separated at the factory. Connect leads from RTD #1, which are grouped and marked, to terminal block TB2 at the numbers 3 and 6 position.
2. Connect the other pair of leads, which are not marked, to terminal block TB2 at the numbers 2 and 5 position.
3. Replace housing cover.
4. Apply power.
5. After probe is installed, proceed to Gain adjustment. Section 3.1.4.

3.1.3 Probe Replacement – Remote Housing

Removal of probe

1. Make sure the power source is turned off.
2. Unscrew and remove housing cover.

-
3. Loosen the screws on the four position terminal block (TB1) to remove the leads from the probe.
 4. Unscrew probe from enclosure.

Installation of replacement probe
(Refer to Figure 6 on page 6.)

1. The probe's leads have been separated at the factory. Connect leads from RTD #1, which are grouped and marked, to the two terminals on TB1 closest to the sensor label (refer to Figure 6).
2. Connect the other pair of leads, which are not marked, to the remaining two positions on TB1.
3. Replace housing cover.
4. Apply power.
5. After probe is installed, proceed to Gain adjustment.

3.1.4 Gain Adjustment

(Refer to Figure 5 on Page 4)

This procedure will adjust the gain of the circuit board to match the sensors in the probe. For best results, perform this procedure at the actual operating conditions.

1. Rotate P2 (time delay) fully counterclockwise.
2. Place Jumper JP1 (fail-safe) in the "L" position.
3. Rotate the gain adjustment potentiometer P3 fully counterclockwise.
4. Turn P1 fully clockwise until clicks are heard, then turn counterclockwise approximately ten (10) turns to obtain a midrange adjustment.
5. Rotate gain adjustment P3 (alignment pot) clockwise until the red LED (D10 on the TDF/TDL or D11 on the TSF/TSL electronics) illuminates. This signifies that the set point has been reached and the relay is energized.
6. Slowly rotate P3 counterclockwise until the red LED (D10 or D11) goes out.
7. Slowly repeat steps 6 and 7 several times.
8. Ensure that the red LED (D10 or D11) is on.
9. Gain adjustment of the sensor and electronics is now complete. Proceed with the operation and calibration in section 2.7.

Note: If P1 is rotated fully clockwise (until clicks are heard) and the red LED (D10 or D11) does not go out, then the gain is too high. Reduce the gain by turning P3 counterclockwise and repeat.

Description		Specification
Supply Voltage		120 VAC, +10%, -15% 50-60 Hz 240 VAC, +10%, -15% 50-60 Hz 24 VDC, ±20%
Power Consumption		5 Watts maximum
Output Relay		
TD Electronics Gold Flash Contacts		SPDT, 10 Amp, 120 VAC, 250 VAC 8 Amp, 30 VDC, 0.5 Amp, 125 VDC
TS Electronics Gold Flash Contacts		DPDT, 10 Amp, 120 VAC, 250 VAC 10 Amp, 28 VDC, 0.5 Amp, 125 VDC or Hermetically Sealed DPDT 5 Amp, 120 VAC, 250 VAC 5 amp, 28 VDC
Operating temperature Electronics		-40° F to +160° F (-40° C to +71° C)
Operating temperature ①		
Sensor		-100° F to +392° F (-73° C to +200° C)
High temperature design		-100° F to +850° F (-73° C to +454° C)
Response Type		1 to 10 seconds (typical - liquid)
Set Point Range-Flow		Water: 0.01 to 5.0 fps (0.003 to 1.5 m/s) Air: 0.1 to 500 fps (0.3 to 150 m/s)
Time Delay		0-100 seconds adjustable
Repeatability		<1% @ constant temperature
Probe Materials of Construction		
Twin Tip		All wetted parts of 316L stainless steel, Hastelloy C, or Monel
Spherical Tip/ Low Flow Body		316L stainless steel
Process Connection		Refer to part number construction
Probe Insertion Length ②③		2" (5 cm) minimum. Available in lengths from 2 to 130" in 1" increments (5 to 330 cm in 1 cm increments) ½" NPT, 1" (2.5 cm) minimum. Available insertion lengths from 1" to 60" (5 to 152 cm)
Cable Length		500 ft. maximum (152 meters maximum)
Shipping Weight		4.6 lbs. (w/2" probe)

① Remote electronics or heat extension recommended for operating temperatures greater than +250° F (+121° C).

② Probes longer than 30" (76 cm) must be secured within the pipe or duct by the customer to prevent movement of the probe. Consult factory for assistance.

③ Consult factory for longer lengths.

DIMENSIONAL SPECIFICATIONS INCHES (MM)

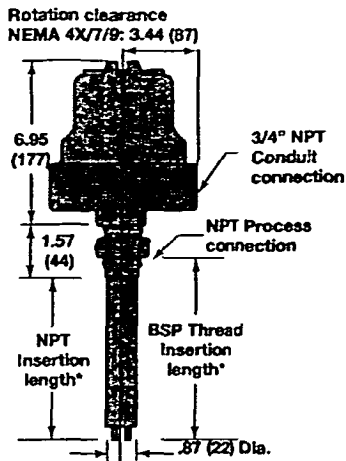


Figure 10
NEMA 4X/7/9 Group C, D, E, F, & G,
Cast Aluminum or
Stainless Steel Housing

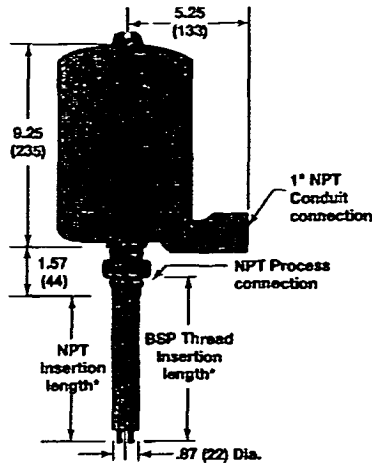


Figure 11
NEMA 4X/7/9 Group B,
Polymer Coated Cast Iron Housing
Housing Code J

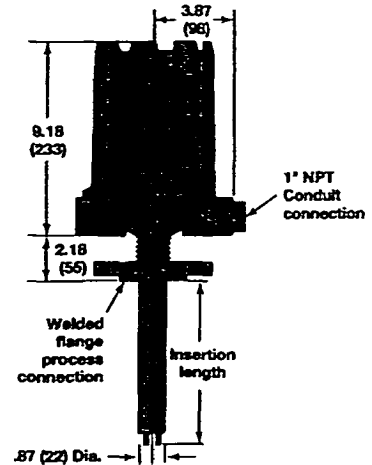


Figure 12
NEMA 4X/7/9 Group B,
Cast Aluminum Housing
Housing Code R

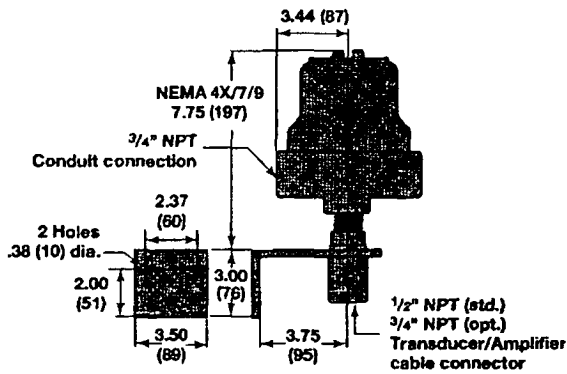


Figure 13
Remote Electronics Housing

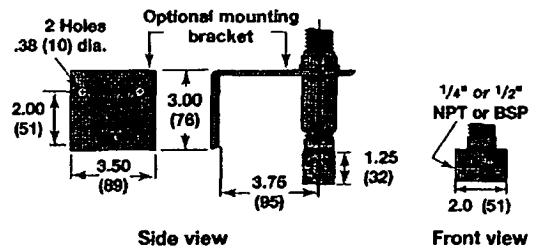


Figure 14
Low Flow Body

DIMENSIONAL SPECIFICATIONS INCHES (MM)

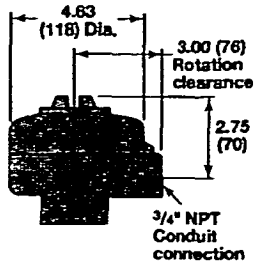


Figure 15
Remote Sensor Housing

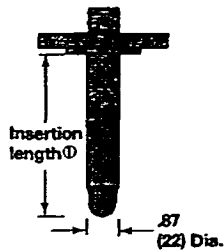


Figure 16
Spherical Tip Probe

Ø Insertion length: 2" to 130" in 1" increments (5 to 330 cm in 1 cm increments). Consult factory for longer lengths.

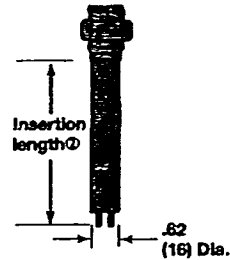


Figure 17
1/2" NPT Probe

Ø Insertion length: 1" (2.5 cm) minimum; 2" to 60" (5 to 152 cm) available.

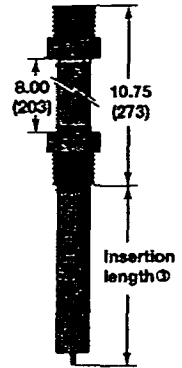
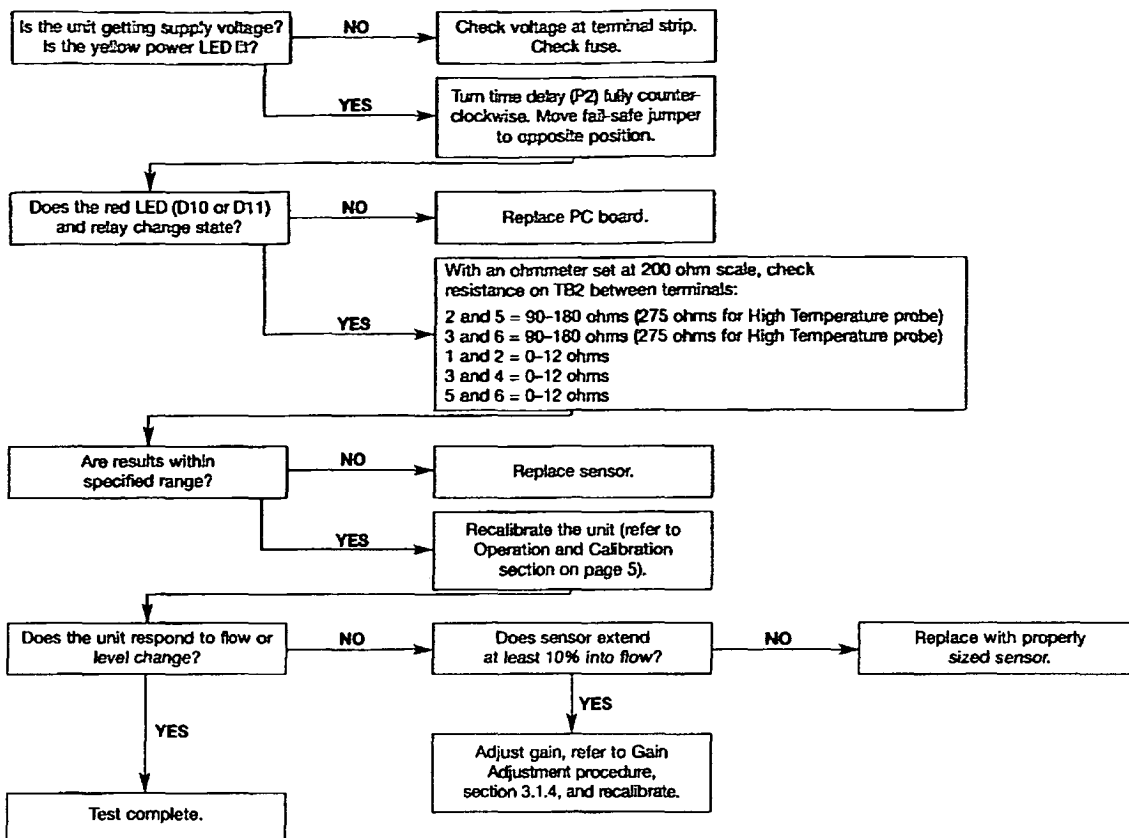


Figure 18
High Temperature Probe with 8" heat extension


Ø Insertion length: 2" to 36" (5 to 91 cm)

Pressure/Temperature Rating


Tip Style	Insertion Length	Pressure/Temperature Rating		
		+100° F (+38° C)	+392° F (+200° C)	+850° F (+450° C)
Twin	2" (5 cm)	3000 psig (206 bar)	2280 psig (157 bar)	—
	3-130" (6-330 cm)	1250 psig (86 bar)	1140 psig (78 bar)	—
Spherical	2-130" (5-330 cm)	600 psig (41 bar)	415 psig (28 bar)	—
Twin w/ 1/2" NPT process connection	1" (2.5 cm)	3000 psig (206 bar)	2280 psig (157 bar)	—
	2-60" (5-152 cm)	1850 psig (127 bar)	1680 psig (115 bar)	—
Low flow body	—	5800 psig (400 bar)	4100 psig (285 bar)	—
High temperature	2-36" (5-90 cm)	6000 psig (413 bar)	4280 psig (295 bar)	3380 psig (233 bar)



4.3.1 FM (Factory Mutual) ①

AGENCY	MODEL APPROVED	APPROVAL CATEGORY	APPROVAL CLASSES
	TX-XXX0-E00	Explosion Proof	Class I, Div 1; Groups C, D
	TX-XXX0-Y00		Class II & III, Div 1; Groups E, F, G Nema Type 4X and IP65
	TX-XX00-J00	Explosion Proof	Class I, Div 1; Groups B, C, D
	TX-XXX0-R00		Class II & III, Div 1; Groups E, F, G NEMA Type 4X and IP 65
	TX-XXX0-E00	Non-Incendive	Class I, Div 2; Groups A, B, C, D
	TX-XXX0-R00		Class II & III, Div 2; Groups E, F, G T4A
	TX-XXX0-J00		NEMA Type 4X and IP 65
	TX-XXX0-Y00		
	PROBE MODEL ♂	Explosion Proof	
	XTX-XXXX-XXX		Class I, Div 1; Groups B, C, D
XT9-XXXX-X00	Class II & III, Div 1; Groups E, F, G ♂ NEMA Type 4X and IP 65		

4.3.2 CSA (Canadian Standards Association) ①

AGENCY	MODEL APPROVED	APPROVAL CATEGORY	APPROVAL CLASSES
	TXX-XXX0-E00	Explosion Proof	Class I, Div 1; Groups C, D
	TXX-XXX0-Y00		Class II & III, Div 1; Groups E, F, G T4A Type 4X
	TXX-XX00-J00	Explosion Proof	Class I, Div 1; Groups B, C, D ②
	TXX-XX00-R00		Class II & III, Div 1; Groups E, F, G T4A Type 4X
	TXX-XXX0-E00	Suitable for	Class I, Div 2; Groups A, B, C, D
	TXX-XXX0-R00		Class II & III, Div 2; Groups E, F, G T4A
	TXX-XXX0-J00		Type 4X
	TXX-XXX0-Y00		
	PROBE MODEL ③	Explosion Proof	Class I, Div 1; Groups B, C, D ②
	XTX-XXXX-XXX		Class II & III, Div 1; Groups E, F, G
	XT9-XXXX-X00		Type 4X

4.3.3 CENELEC (Comité Européen de Normalisation Electrotechnique) ④

AGENCY	MODEL APPROVED	APPROVAL CATEGORY	APPROVAL CLASSES
	TXX-XXX0-U00	Explosion Proof	EEx d IIC T5 (-20 °C to +90 °C)
	TXX-XXX0-V00		T4 (-40 °C to +55 °C)
	TXX-XXX0-W00		

4.3.4 SAA

MODEL APPROVED	APPROVAL CATEGORY	APPROVAL CLASSES
TDF-1100-E00	Explosion Proof	Ex d IIC (Hydrogen Only) T6 IP65
TDF-1120-E00		

① FM/CSA approved based on a maximum temperature rise of sensor of 180° F (100° C) above the process temperature.

② Probe type XT1-XXX0-XXX limited to Class I Locations only. Class II, Groups E, F & G approval only with spherical tip (XT2-XXX0-XXX)

③ CSA approval for Group B with integral electronics only.

④ Other CENELEC approved model available.



These units have been tested to EN 50081-2 and EN 50082-2 and are in compliance with the EMC Directive 89/336/EEC.

4.3.5 Explosion Proof

REVISIONS		REV. & DATE	CHANGE NO.
A	RELEASED	CP 12-92	3172-011
B	ADDED "CLASS II, TDX-1320-1000", "SENSOR TYP. . . FOR BOTH . . . OPTIONS", "FOR TDX-1320-1000-1000", "FOR TDX-1320-1000-1000" TO HAZ. LOC. RING; "CONTROLLED/TRANSITION" IN "MAGNETROL MODELS" BOX	4-93	3185-058
C	REVISED DESCRIPTION: "TDX-1320-1000" WAS "TDX-1320-1000"; "TWIN" WAS "SENSOR"; ADDED "MAGNETROL MODEL" BOX	CP 6-94	3172-038
D	ENG'D NOTES 1 & 2 ADDED; NOTE 3, ENG'D & ADDED TO HAZARDOUS LOCATION INFO	JAN 95	3042-438

HAZARDOUS LOCATION

CLASS I, DIV. 1, GROUPS B, C & D; CLASS II & III FOR TDX-1320-1000.
TWIN TIP MAY NOT BE LOCATED IN CLASS II & III ENVIRONMENTS, FOR BOTH INTEGRAL AND REMOTE OPTIONS.
CLASS I, DIV. 1 GROUPS C & D; CLASS II & III FOR TDX-1320-1000.
CLASS I, DIV. 1 GROUPS B, C & D; CLASS II & III FOR TDX-1320-1000.
CLASS I, DIV. 2 GROUPS A, B, C & D; CLASS II & III, DIV. 2 GROUPS E, F & G WITH XP PROBE CLASS I, DIV. 1 GROUPS B, C & D TYPE 4X ENCLOSURE.

REMOTE PROBE SHOWN AS EXAMPLE

MAGNETROL MODEL
TXX-XXX0-X00

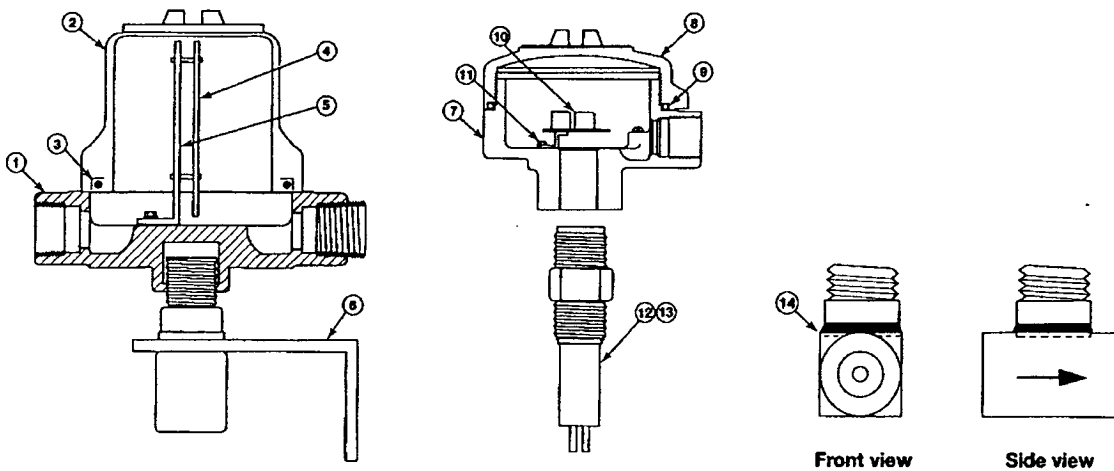
NOTES:
1. THE NEC OR CEC MUST BE FOLLOWED WHEN INSTALLING THIS EQUIPMENT.
2. NO REVISIONS SHALL BE MADE TO THIS DRAWING WITHOUT FACTORY MUTUAL RESEARCH OR CSA AUTHORIZATION.
3. FOR CSA: WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2. FOR CSA: WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

P/N 99-5048-001

AGENCY LISTED DRAWING
ALL REVISIONS TO THIS DRAWING REQUIRE QA APPROVAL

INSTALLATION DRAWING THERMATEL
C. ROBIN DATE 12-17-92
CHART, HOF/CHARTER DATE 1-12-93
JIMMY M. HAYNES DATE 1-12-93
MAGN 3172-011 SECTION NO. C

Magnetrol
5300 BELLEVUE BLVD., GAITHERSBURG, MD 20878
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4.4.2 Replacement Parts

1	Base NEMA 4X/7/9	004-9182-003	
2	Cover, NEMA 4X/7/9	002-6204-600	
3	O-Ring, NEMA 4X/7/9	012-2101-345	
4	Main PC Board Integral Sensor	TDF/TDL with 10 amp SPDT relay	TSF/TSL with 10 amp DPDT relay
	120 VAC	Z30-3536-002	Z30-3572-001
	240 VAC	Z30-3536-004	Z30-3572-003
	24 VDC	Z30-3536-006	Z30-3572-005
	Main PC Board Remote Electronics		
	120 VAC	Z30-3536-003	Z30-3572-002
	240 VAC	Z30-3536-005	Z30-3572-004
	24 VDC	Z30-3536-007	Z30-3572-006
	Main PC Board, Integral Electronics		TSF/TSL with 5 amp Hermetic Sealed relay
	120 VAC		Z30-3571-001
	240 VAC		Z30-3571-003
	24 VDC		Z30-3571-005
	Main PC Board, Remote Electronics		
	120 VAC		Z30-3571-002
	240 VAC		Z30-3571-004
	24 VDC		Z30-3571-006
5	Bracket Kit	089-5212-001	
6	Remote Mounting Bracket		
	1/2" NPT Conduit Connection	036-3805-001	
	3/4" NPT Conduit Connection	036-3805-003	
7	Remote Sensor Housing Base	004-9104-001	
8	Remote Sensor Housing Cover	004-9105-001	
9	Remote Sensor Housing O-Ring	012-2101-345	
10	Remote Sensor PC Board	Z30-3540-001	
11	Remote Sensor Bracket Kit	089-5212-002	
12*	Standard Probe		
	316L Stainless Steel	XTX-X220-XXX	
	Hastelloy C	XTX-XHC0-XXX	
	Monel	XTX-XMM0-XXX	
13*	High Temperature Probe		
	316L Stainless Steel	XTH-XXS0-XXX	
	Hastelloy C	XTH-XXH0-XXX	
14	Low Flow Body	XT9-X22X-XXX	

*XXX = Insertion length in inches or centimeters

Example: 4T1-1220-012 has a 12 inch insertion length;
6T1-1220-012 has a 12 cm insertion length

4.5.1 Electronics Models

BASIC MODEL NUMBER

D	Standard (TD) SPDT Relay
S	On-demand electronic self-test (TS) DPDT relay

APPLICATION

F	Flow
L	Level

OUTPUT

1	10 Amp SPDT relay w/gold flashed contacts (Model TD)
2	10 Amp DPDT relay w/gold flashed contacts (Model TS)
4	5 Amp hermetically sealed DPDT relay w/gold flashed contacts (Model TS)

INPUT VOLTAGE

0	120 VAC
1	240 VAC
2	24 VDC

MOUNTING

0	Integral
2	Remote (includes electronics housing bracket and remote sensor housing)

HOUSING

E	NEMA 4X/7/9	Polymer coated aluminum dual conduit connection, 1/2" NPT
J	NEMA 4X/7/9 Group B	Polymer coated cast iron (integral only) Single conduit connection, 1" NPT
R	NEMA 4X/7/9 Group B	Polymer coated die-cast aluminum dual conduit connection, 1" NPT
U	CENELEC*	Polymer coated aluminum dual cable entry, PG 13.5
V	CENELEC*	Polymer coated aluminum dual cable entry, 1/2" NPT
Y	NEMA 4X/7/9	316 stainless steel, single conduit connection, 1/2" NPT
W	CENELEC*	Polymer coated aluminum, dual cable entry, M 20 X 1.5

*additional CENELEC approved housings available; consult factory.

T — 0 0 0 complete order code for
Thermal Electronics

PROBE DESIGN

4	Probe length in inches
6	Probe length in centimeters

TIP STYLE

1	Twin tip
2	Spherical tip - available in 316L stainless steel only (code 22)

PROCESS CONNECTION*

1	½" NPT	<p>Raised faced flange socket welded to probe</p>
2	1" NPT	
3	1½" sanitary flange	
4	2" sanitary flange	
A	½" NPT – Twin tip, stainless steel only	
B	1" 150#	
C	1½" 150#	
D	2" 150#	
E	1" 300#	
F	1½" 300#	
G	2" 300#	<p>Raised faced flange socket welded to probe</p>
H	1" 600#	
J	1½" 600#	
K	2" 600#	

* DIN flange process connections available - consult factory

MATERIAL

22	316L stainless steel
HC	Hastelloy C-276
MM	Monel

Construction to meet NACE Std. MR0175 is also available; consult factory.

INSERTION LENGTH with PROBE DESIGN code 4

001	1' min. (½" NPT connection only)
002	2' min. (ESP with ½" NPT connection only)
.	3' to 130' max. in 1' increments

* Example: 4 inches = Code 004.
For lengths over 130 inches, consult factory.

INSERTION LENGTH with PROBE DESIGN code 6

003	2.5 cm min. (½" NPT connection only)
005	5 cm min. (ESP with ½" NPT connection only)
•	6 to 330 cm max., 1 cm increments

* Example: 25 cm = Code 025.
For lengths over 330 cm, consult factory.

	T		-			0	-			
--	---	--	---	--	--	---	---	--	--	--

complete order code for
Thermate! Probe

4.5.3 High Temperature Probe* Models

High temperature probe includes 8" (20 cm) heat extension

PROBE DESIGN

4	Probe length in inches
6	Probe length in centimeters

PROCESS CONNECTION*

11	¾" NPT	Raised faced flange socket welded to probe
21	1" NPT	
23	1" 150#	
24	1" 300#	
25	1" 600#	
26	1" 1500#	
33	1½" 150#	
34	1½" 300#	
35	1½" 600#	
36	1½" 1500#	
37	1½" 2500#	
43	2" 150#	
44	2" 300#	
45	2" 600#	
46	2" 1500#	
47	2" 2500#	

* DIN flange process connections available – consult factory

MATERIAL

S	316L stainless steel
H	Hastelloy C-276

INSERTION LENGTH with PROBE DESIGN code 4 or 5

002	2" to 36" max. in 1" increments
to	
036	Example: 4 inches = Code 004

INSERTION LENGTH with PROBE DESIGN code 6 or 7

005	5 cm minimum
007 to 091	7 cm to 91 cm max. in 1 cm increments Example: 8 cm = Code 008

	T	H	-			0	-			
--	---	---	---	--	--	---	---	--	--	--

complete order code for
Thermatel High temperature probe

4.5.4 Low Flow Body Models

LOW FLOW DESIGN

4	Standard
---	----------

FLOW BODY CODE

C	1/4"
D	1/2"

PROCESS CONNECTION

1	NPT
2	BSP

MOUNTING BRACELET

0	None
1	Provided

T	9
---	---

2	2
---	---

0	0
---	---

complete order code for
Thermatel Low flow body

4.5.5 Connecting Cable Models

CONNECTING CABLE IN FEET

Cable length in feet; 10 feet minimum, 500 feet maximum length
Example: 12 feet = Code 012

0	3	7	3	1	8	6			
---	---	---	---	---	---	---	--	--	--

complete order code for
Thermatel Connecting cable

CONNECTING CABLE IN METERS

3 meters minimum, 152 meters maximum length
Example: 3 meters = Code 003

0	3	7	3	1	9	8			
---	---	---	---	---	---	---	--	--	--

complete order code for
Thermatel Connecting cable

ASSURED QUALITY & SERVICE COST LESS

Service Policy

Owners of Magnetrol/STI controls may request the return of a control or any part of a control for complete rebuilding or replacement. They will be rebuilt or replaced promptly. Controls returned under our service policy must be returned by Prepaid transportation. Magnetrol/STI will repair or replace the control at no cost to the purchaser (or owner) other than transportation if:

1. Returned within the warranty period; and
2. The factory inspection finds the cause of the claim to be covered under the warranty.

If the trouble is the result of conditions beyond our control; or, is NOT covered by the warranty, there will be charges for labor and the parts required to rebuild or replace the equipment.

In some cases it may be expedient to ship replacement parts; or, in extreme cases a complete new control, to replace the original equipment before it is returned. If this is desired, notify the factory of both the model and serial numbers of the control to be replaced. In such cases, credit for the materials returned will be determined on the basis of the applicability of our warranty.

No claims for misapplication, labor, direct or consequential damage will be allowed.

Return Material Procedure

So that we may efficiently process any materials that are returned, it is essential that a "Return Material Authorization" (RMA) number be obtained from the factory, prior to the material's return. This is available through Magnetrol/STI's local representative or by contacting the factory. Please supply the following information:

1. Company Name
2. Description of Material
3. Serial Number
4. Reason for Return
5. Application

Any unit that was used in a process must be properly cleaned in accordance with OSHA standards, before it is returned to the factory.

A Material Safety Data Sheet (MSDS) must accompany material that was used in any media.

All shipments returned to the factory must be by prepaid transportation.

All replacements will be shipped F.O.B. factory.

NOTE: See Electrostatic Discharge Handling Procedure on page 3.



5300 Belmont Road • Downers Grove, Illinois 60515-4400 • 630-969-4000 • Fax 630-969-9489 • www.magnetrol.com
145 Jardin Drive, Units 1 & 2 • Concord, Ontario Canada L4K 1X7 • 905-738-9800 • Fax 905-738-1306
Holkensstraat 6 • B 9240 Zate, Belgium • 062 45.11.11 • Fax 062 45.08.93
Regent Business Ctr., Jubilee Rd. • Burgess Hill, Sussex RH15 9TL U.K. • 01444-871313 • Fax 01444-871317



5300 Belmont Road • Downers Grove, Illinois 60515-4400 • 630-969-4028 • Fax 630-969-9489 • www.sticontrols.com

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MERCER VALVE COMPANY INC
 INVENTOR OF AUTO-SEAT TECHNOLOGY

COMPANY OVERVIEW

PRODUCTS AND SERVICES

ORDERING

USEFUL LINKS

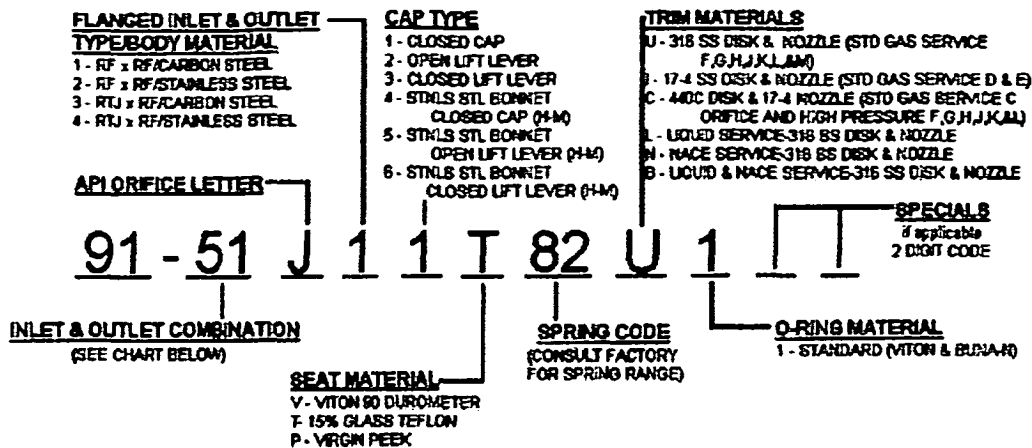
9100 Flanged Valves SPECIFICATIONS

+ INTRODUCTION
+ SPECIFICATIONS
+ BILL OF MATERIALS
+ PRODUCT NUMBERING
+ SELECTION TABLE
+ VALVE SIZING
+ ORDERING

API Orifice Letter	C	D	E	F	G
Orifice Diameter (in.)	0.281	0.394	0.520	0.655	0.775
API Orifice Area (sq. in.)	—	0.110	0.196	0.307	0.503
ASME Actual Orifice Area (sq. in.)	0.062	0.122	0.212	0.337	0.472
Inlet Sizes Offered	3/4", 1"	3/4", 1"	1", 1 1/2"	1 1/2"	1 1/2", 2"
Pressure Ranges (psig)	15-2999	15-2999	15-2400	15-2400	15-2000
ASME Gas "Slope" (90%)	0.93	1.83	3.18	5.06	7.08
Flow Coefficient "K" (90%) Gas	0.818	0.818	0.818	0.818	0.818
Flow Coefficient "K" (90%) Liquid	0.707	0.707	0.707	0.707	0.707

Temperature Ranges

 Standard: -20°F to +400°F Extended: -180°F to +550°F
 (Consult Factory for Material Specifications)



INLET AND OUTLET COMBINATIONS

11 - 3/4" 150 x 1" 150	22 - 1" 150 x 1 1/2" 150	33 - 1 1/2" 150 x 2" 150	51 - 2" 150 x 3" 150	62 - 3" 150 x 4" 150 (J, K)
12 - 3/4" 300 x 1" 150	23 - 1" 300 x 1 1/2" 150	34 - 1 1/2" 300 x 2" 150	52 - 2" 300 x 3" 150	64 - 3" 300 x 4" 150 (J, K)
13 - 3/4" 600 x 1" 150	24 - 1" 600 x 1 1/2" 150	35 - 1 1/2" 600 x 2" 150	53 - 2" 600 x 3" 150	65 - 3" 600 x 4" 150 (J, K)
14 - 3/4" 900 x 1" 300	25 - 1" 900 x 1 1/2" 300	36 - 1 1/2" 900 x 2" 300	54 - 2" 900 x 3" 300	66 - 3" 900 x 4" 150 (J, K)
15 - 3/4" 1500 x 1" 300	26 - 1" 1500 x 1 1/2" 300	37 - 1 1/2" 1500 x 2" 300	57 - 2" 1500 x 3" 300	67 - 3" 150 x 4" 150 (J)
16 - 1" 150 x 1" 150	27 - 1" 150 x 2" 150	42 - 2" 150 x 2" 150	55 - 1 1/2" 150 x 3" 150	68 - 3" 300 x 4" 150 (J)
17 - 1" 300 x 1" 150	28 - 1" 300 x 2" 150	43 - 2" 300 x 2" 150	56 - 1 1/2" 300 x 3" 150	70 - 4" 150 x 6" 150
18 - 1" 600 x 1" 150	29 - 1" 600 x 2" 150	44 - 2" 600 x 2" 150	74 - 1 1/2" 600 x 3" 150	71 - 4" 300 x 6" 150
19 - 1" 900 x 1" 300	31 - 1" 900 x 2" 300	45 - 2" 900 x 2" 300	75 - 1 1/2" 900 x 3" 300	72 - 4" 600 x 6" 150
21 - 1" 1500 x 1" 300	32 - 1" 1500 x 2" 300	46 - 2" 1500 x 2" 300	84 - 1 1/2" 1500 x 3" 300	93 - 4" 900 x 6" 150

VALVE SIZE INLET X OUTLET	AVAILABLE ORIFICE SIZE	INLET- OUTLET CODE	PRESSURE LIMITS (psig)
3/4" 150 X 1" 150	C,D	11	15-285
3/4" 300 X 1" 150	C,D	12	286-740
3/4" 600 X 1" 150	C,D	13	741-1480
3/4" 900 X 1" 300	C,D	14	1481-2220
3/4" 1500 X 1" 300	C,D	15	2221-2999
1" 150 X 1" 150	D,E	16	15-285
1" 300 X 1" 150	D,E	17	286-740
1" 600 X 1" 150	D,E	18	741-1480
1" 900 X 1" 300	D,E	19	1481-2220
1" 1500 X 1" 300	D,E	21	2221-LIMITS
1" 150 X 1 1/2" 150	E	22	15-285
1" 300 X 1 1/2" 150	E	23	286-740
1" 600 X 1 1/2" 150	E	24	741-1480
1" 900 X 1 1/2" 300	E	25	1481-2220
1" 1500 X 1 1/2" 300	E	26	2221-2400
1" 150 X 1 1/2" 150	F	22	15-285
1" 300 X 1 1/2" 150	F	23	286-740
1" 600 X 1 1/2" 150	F	24	741-1480
1" 900 X 1 1/2" 300	F	25	1481-2220
1" 1500 X 1 1/2" 300	F	26	2221-2400
1" 150 X 2" 150	D*,E*	27	15-285
1" 300 X 2" 150	D*,E*	28	286-740
1" 600 X 2" 150	D*	29	741-1480
1" 900 X 2" 300	E	29	741-1480
1" 900 X 2" 300	D,E	31	1481-2220
1" 1500 X 2" 300	D,E	32	2221-LIMITS
1 1/2" 150 X 2" 150	F*,G	33	15-285
1 1/2" 300 X 2" 150	F*,G	34	286-740
1 1/2" 600 X 2" 150	F*,G	35	741-1480
1 1/2" 900 X 2" 300	F,G	36	1481-2220
1 1/2" 900 X 2" 300	D*,E*	36	1481-2220
1 1/2" 1500 X 2" 300	D*,E*	92	2221-LIMITS
1 1/2" 150 X 2" 150	H	33	15-285
1 1/2" 300 X 2" 150	H	34	286-740
1 1/2" 600 X 2" 150	H	35	741-850
1 1/2" 150 X 3" 150	G*	55	15-285
1 1/2" 300 X 3" 150	G*	56	286-740
1 1/2" 600 X 3" 150	G*	74	741-1480
1 1/2" 900 X 3" 300	F*,G*	75	1481-2220
1 1/2" 1500 X 3" 300	F*	94	2221-LIMITS
1 1/2" 150 X 3" 150	H*	55	15-285
1 1/2" 300 X 3" 150	H*	56	286-740
2" 150 X 2" 150	G	42	15-285
2" 300 X 2" 150	G	43	286-740
2" 600 X 2" 150	G	44	741-1480
2" 900 X 2" 300	G	45	1481-2000
2" 150 X 2" 150	H	42	15-285
2" 300 X 2" 150	H	43	286-740
2" 600 X 2" 150	H	44	741-850
2" 150 X 2 1/2" 150	H	46	15-285
2" 300 X 2 1/2" 150	H	47	286-740
2" 600 X 2 1/2" 150	H	48	741-850
2" 600 X 2 1/2" 150	H	48	851-1480
2" 900 X 2 1/2" 150	H	89	1481-2000
2" 150 X 3" 150	G	51	15-285
2" 300 X 3" 150	G	52	286-740
2" 600 X 3" 150	G	53	741-1480
2" 900 X 3" 300	G	54	1481-2000
2" 300 X 3" 150	H*	52	286-740
2" 600 X 3" 150	H*	53	741-850
2" 600 X 3" 150	H*	53	851-1480
2" 900 X 3" 150	H*	91	1481-2000
2" 150 X 3" 150	J*	51	15-285
2" 300 X 3" 150	J*	52	285-450
2" 300 X 3" 150	J*	52	451-740
3" 150 X 4" 150	J,K*	62	15-285
3" 300 X 4" 150	J	64	286-450

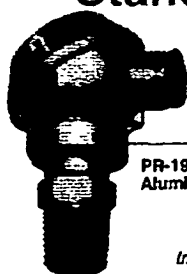
Platinum RTD Probes

Industrial Design

Standard and Metric Dimensions

PR-Series

Base Unit



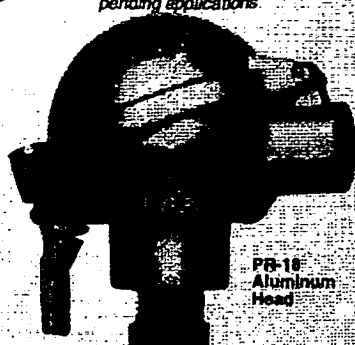
PR-19 Sub-Miniature
Aluminum Head

PATENTED

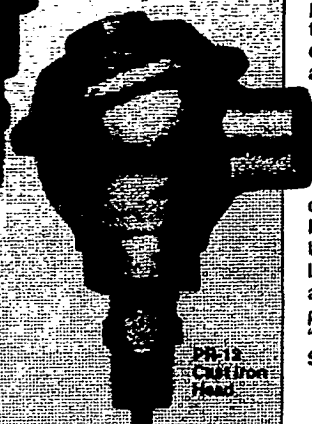
Covered by U.S. and
International patents and
pending applications



PR-14 Miniature
Aluminum Head



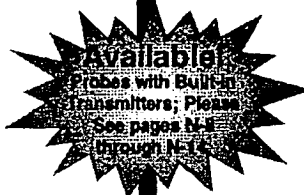
PR-18
Aluminum
Head



PR-12
Cast Iron
Head

This rugged design offers a variety of protection heads with 1/2 NPT mounting threads and 304SS sheath. The length dimension includes a 12 mm (1/2") thread allowance for use with thermowells or for direct immersion into the process. The standard probe uses a Style 2 (3-wire) lead configuration, but other configurations are available. All probes include a screw terminal block for easy connection of extension wire. Intermediate probe lengths are available. Use the next longest probe's price. Lengths over 600 mm (24") are also available; contact Sales. For replacement probes, model without head, add suffix "-RP" to the part number and subtract \$14 from the price.

**ALL MODELS AVAILABLE
FOR FAST DELIVERY!**



For dimension and thread information on these other protection head models and thermowell plans, see A-135 and Section B.

Use RTD Extension Wire, EX-100 Series, Class A, see text page.

1 to 10 unitsNet
11 to 24 units5%
25 to 49 units10%
50 units and up15%

Standard Dimensions - Platinum Industrial RTD Probes

PR-(*)-2-100-(*)-6-E	2	100	6"	\$90	\$94
PR-(*)-2-100-(*)-9-E	2	100	9"	90	94
PR-(*)-2-100-(*)-12-E	2	100	12"	90	94
PR-(*)-2-100-(*)-18-E	2	100	18"	93	97
PR-(*)-2-100-(*)-24-E	2	100	24"	99	100

*Specify: 1/8, 3/16 or 1/4 for probe diameter in inches. Other lengths readily available

**Specify protection head style: 12 = cast iron; 14 = miniature aluminum; 18 = aluminum; 19 = subminiature aluminum.

Ordering Example: PR-12-2-100-1/14-6-E, industrial RTD probe with cast iron head, 3-wire configuration (style 2), 100 ohm, 1/4" diameter, 6" length, European curve ($\alpha = 0.00385$), \$90.

†For other lead types please see page C-5.

Consult our Sales Department for Class A or lead wire with stainless steel overbraid.

Metric Dimensions - Platinum Industrial RTD Probes

PR-(*)-2-100-(*)-150-E	2	100	150 mm	\$90	\$94
PR-(*)-2-100-(*)-225-E	2	100	225 mm	90	94
PR-(*)-2-100-(*)-300-E	2	100	300 mm	90	94
PR-(*)-2-100-(*)-450-E	2	100	450 mm	93	97
PR-(*)-2-100-(*)-600-E	2	100	600 mm	94	100

*Specify: M30, M45 or M60 for probe diameter in millimeters. Other lengths readily available

**Specify protection head style: 12 = cast iron; 14 = miniature aluminum; 18 = aluminum; 19 = subminiature aluminum.

†For other lead types please see page C-5.

Ordering Example: PR-12-2-100-M60-150-E, industrial RTD probe with cast iron head, 3-wire configuration (style 2), 100 ohm, 6 mm diameter, 150 mm length, European curve ($\alpha = 0.00385$), \$90.



Click [here](#) for larger image.



Product Specs.
[click here](#)

This rugged design offers a variety of protection heads with 1/2" NPT mounting threads and 304 SS sheath. The length dimension includes a 1/2" thread allowance for use with thermowells or for direct immersion into the process. The standard probe uses a Style 2 (3-wire) lead configuration, but other configurations are available. All probes include a screw terminal block for easy connection of copper extension wire. Standard probe diameters are 1/8, 3/16, and 1/4". Standard probe lengths are 6, 9, 12, 18, and 24". Intermediate probe lengths are available at the next longer standard probe's price. Lengths over 24" are also provided; contact Sales Department for availability and pricing.

For replacement probes, i.e. models without head, add suffix "-RP" to the part number and subtract \$14 from the price..

Pricing for several popular models is shown in the ordering table below. Use the Part Number Builder to obtain pricing for other models.
For complete product specifications see the Related Links section at the bottom of this page.

To Order (Specify Model Number, see variations below in part number builder table)

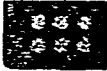
Part Number	Availability	Price	Description	Qty.
PR-12-2-100-1/4-18-E	In Stock	\$93.00	Industrial RTD probe with cast iron head, 3-wire configuration, 100 ohm, 1/4" diameter, 18" length, european curve (a = 0.00385)	<input type="text" value="0"/>
PR-12-2-100-1/4-9-E	In Stock	\$90.00	Industrial RTD probe with cast iron head, 3-wire configuration, 100 ohm, 1/4" diameter, 9" length, european curve (a = 0.00385)	<input type="text" value="0"/>
PR-12-2-100-1/8-6-E	In Stock	\$94.00	Industrial RTD probe with cast iron head, 3-wire configuration, 100 ohm, 1/8"	<input type="text" value="0"/>

PR-12-2-100-1/8-24-E In Stock \$100.00

diameter, 6" length, european curve (a = 0.00385)

Industrial RTD probe with cast iron head, 3-wire configuration, 100 ohm, 1/8" diameter, 24" length, european curve (a = 0.00385)

0



† All dollar amounts on this site are shown in US currency.

Note: Teflon coated probes and dual element probes are also provided; contact Sales for availability and pricing.

Ordering Example: (1) PR-12-2-100-1/4-12-E Industrial RTD probe with cast iron head, 3-wire configuration, 100 ohm, 1/4" diameter, 12" length, european curve (a = 0.00385) = \$90

Part Number Builder

(1) (2)

PR-12-2-100- 1/8 - 6 - E

Option Descriptions

(1) Probe Diameter

Select

1/8 for 1/8 inch

1/4 for 1/4 inch

3/16 for 3/16 inch

(2) Sheath Length

Select

6 for 6 inch

9 for 9 inch

12 for 12 inch

18 for 18 inch

24 for 24 inch

NOTE: All combinations may not be valid, check spec sheet for valid part numbers.

Related Links - Product Spec Sheet , Related Products

Product Spec Sheet

Click here to view complete Product Specifications in PDF format.

Related Products

General RTD Specifications: RTD Tech Reference

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MXV
MMV
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