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	TITLE: SPECIFICATION OF P.P.SET FOR GOV AND MIV SYSTEM	241506453-A	Page 1 of 21

PROJECT: ARUN-III HEP (4 X 225 MW) V. FRANCIS

1. GENERAL

This specification covers design, manufacturing, assembly, testing and supply of oil pressure pumping set for the operation / control of **Guide vane and MIV servomotors**. It should be designed for continuous duty type. Basically oil pressure system shall be designed according to the Diagram of Control gear drawing no. **32210120501 Rev.00**. The parts which are not indicated in detail on this drawing such as piping, fittings, valves, flanges & other instruments should also be supplied by the supplier. Complete system to be supplied in fully tested & assembled condition.

2. BASIC DESIGN DATA

- A. Basic Design - BHEL BHOPAL
- B. Type - Each system has dual installation of oil Pump motor set with continuous duty type.
- C. Pressures
Normal working pressure - 100 kg/cm²
- D. Tank design Temp. - (-) 10 to (+) 45° C
- E. Operating Feature
 - E.1. Two pumps (main +standby) shall be operated when pressure falls to preset pressure settings. However, as per our design at times both pumps (main + standby) may be in operation.
 - E.2. Pressure pipe sizes are to be decided based on oil velocity in the pipe, which shall not be more than 3 m/sec & for drain pipes the velocity should not be more than 2 m/sec (It is for reference). However, **pipe sizes should be same as specified in the control gear diagram.**
 - E.3. The pressurized oil in the oil piston accumulator is controlled within specified limits by solenoid operated unloader valve with built in relief valves, which controls discharge oil from pump to oil piston accumulator or to oil sump tank.

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APPROVED		MM(H)	04	SPS	AP	AP	5.10.2020
DATE							



3 TECHNICAL DETAILS AND SCOPE OF SUPPLY:

3.1 SUMP TANK (Device No. 313)

- a) Capacity = 5625 liters
- b) Dimensions Internal: Width = 1500 mm
: Length = 2500 mm
: Height = 1500 mm
Normal oil tank level: = 700 mm from bottom of sump
- c) Material for sump tank : IS: 2062 Gr. E250 (Fe 410 W A) Quality A
Material of Pipes : Seamless Steel
Material of flanges : Steel
- d) Plate thickness:
 - Bottom Plate - 10 mm
 - Side plate - 8 mm
 - Top plate - 20 mm

3.2 OIL PUMP (Device No. 301-A & B)

- a) Number - 2 Nos.
- b) Type - Triple screw pump
- c) Rated speed - 2900 rpm
- d) Rotation - Clock wise view from motor side
- e) Delivery pressure - 100 kg/cm²
- f) Suction pressure - (-) 0.4 kg/cm²
- g) Capacity - **400 (+10%,-5%) LPM** as per VDMA std. 24284 Group-II
- h) Medium of liquid - ISO – VG - 46 mineral oil heavy duty
- i) Viscosity range - 37-150 CST
- j) Range of permissible - (-) 10 deg. To (+) 75 deg. C
temperature
- k) Connection - Delivery: Pipe & Flange type 65 NB, DIN 100 ATA

The distance between bottom of the suction pipe and bottom of the tank to be maintained between 70-90 mm and the same to be shown in arrgt. drg. also by successful bidder.

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3.3) ELECTRICAL MOTOR (Device no. 88 MG-A & B)

Number	-	2 Nos.
Type	-	Totally enclosed fan cooled vertical Flange mounting, Squirrel cage induction motor
Output	-	110 kW depends on pump (301IV- A & B) characteristics
Voltage	-	415 V $\pm$ 10% , 50 Hz $\pm$ 5% , 3 phase
Speed	-	2900 rpm
Mounting	-	To suit oil pump (Device No. 301-A & B)
Insulation class	-	Class-F or better
Temp. raise	-	Should be limited to Class-B at 10 % continuous overload above rated load condition
Efficiency class	-	IE-3

Note: a) Motor should be capable of operation for a period of not less than 5 minutes with a voltage of 25% below nominal voltage at nominal frequency without injurious overheating.

b) for detailed specification refer clause 1.8.9 of general technical specification attached

3.4) JOCKEY PUMP (Device No.301-c)

Qty.	-	1 No.
Type	-	Gear/Vane
Rated Speed	-	1450 RPM
Rotation	-	Clockwise view from motor side
Delivery Pressure	-	100 kg/cm ²
Suction pressure	-	(-) 0.4 kg/cm ²
Capacity	-	20 LPM as per VDMA std. 24284 Group-II
Medium of liquid	-	ISO – VG - 46 mineral oil heavy duty
Connection	-	15 NB discharge side

3.5) MOTOR FOR JOCKEY PUMP (Device No.88MG-C)

Qty.	-	1 No.
Type	-	Totally enclosed fan cooled vertical Flange mounting, Squirrel cage induction motor
Output	-	7.5 kW depends on pump (349) characteristics
Voltage	-	415 V $\pm$ 10% , 50 Hz $\pm$ 5% , 3 phase
Speed	-	1450 RPM synchronous
Insulation	-	Class-F or better
Mounting	-	To suit oil pump (Device No. 301-C)
Temp. raise	-	Should be limited to Class-B at 10 % continuous overload above rated load condition

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Efficiency class - IE-3

Note:a) for detailed specification refer clause 1.8.9 of general technical specification attached

3.6) MANIFOLD ASSEMBLY FOR MAIN & STAND BY PUMP:-

Each manifold assembly Consisting of device nos. 302-A, 306-A, 322-A, 363-A & 20G- A).

(Manifold block must have test points 'T1 to T4' as per DCG **32210120501 Rev.00**)

3.6.1 UNLOADER VALVE ASSY. (DEVICE NO. 306-A, 322-A, 363-A WITH 20G-A).

(a) Cartridge valve (Device no. 306-A)

Discharge capacity - 400 LPM + 10%
Type - Spring loaded poppet type without cushion
Size - NG 50 or more

(b) Pressure Relief Valve (Device no. 322-A)

Set to operate at - 110 kg/cm²
Size - Bidder to decide.
Type - Direct operated spring loaded type.

(c) Solenoid operated valve (Device no. 363-A with 20G- A)

Type: 4-way, 2-position, spring off-set, solenoid operated with manual Over-ride Facility & shall be of continuously rated type normally open valve.

Size: Bidder to decide.

Supply voltage: 230 VAC, 50 Hz with plugin connector of LED indicator type

3.6.2 Non return valve (Device No.302-A & B)

Type - Spring loaded poppet type [Inline mounting / manifold subplate mounting type]
Cracking Pressure - 0.4 to 0.5 kg/cm²
Capacity - Capable to cope-up the discharge of pump (main / standby) (400 LPM+10%) at a pressure of 100 kg/cm² with pressure drop not more than 2 kg/cm²
Size - Dia 50 or more

3.7 MANIFOLD ASSEMBLY FOR JOCKEY PUMP:-

(Consisting of Device Nos. 302-C, 322-C, 363-C & 20G-C)

(Manifold block must have test points 'T5 & T6' as per DCG **32210120501 Rev.03**)

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3.7.1 NON RETURN VALVE (Device No. 302-C)

Type	-	Spring loaded poppet type (Inline mounting / manifold sub plate mounting type)
Cracking Pressure	-	0.4 to 0.5 kg/cm ²
Capacity	-	Capable to cope-up the discharge of jockey pump (20 LPM+10%) at a pressure of 100 kg/cm ² with pressure drop (Del P) not more than 2 kg/cm ²
Size	-	Dia 15 or more

3.7.2 SOL. VALVE (363-C, 20G-C):

Type: 4-way, 2-position, spring off-set, solenoid operated with manual Over-ride Facility & shall be of continuously rated type normally open valve.
Flow: 20 LPM +10%
Size: NG10
Supply voltage: 230 VAC, 50 Hz

3.7.3 PR .RELIEF VALVE (322-C):

Set to operate at	-	110 kg/cm ²
Size	-	Bidder to decide to cope up jockey pump discharge of 20 LPM+10%
Type	-	Direct operated spring loaded type.

Operating Characteristics:

In first step during startup of power pack solenoid of main pump - motor set is in de-energized condition and unloader valve change the state to unload compulsorily regardless of pressure in the oil pressure accumulator and pump-motor starts on no-load. Then solenoids of main pump motor gets energized after 10-15 sec through timer and unloader valve return to its normal position under pilot pressure and pump-motor gets loaded. In second step now starting and stopping of motor is controlled within the specified limit of 100 – 96 kg/cm² by pressure switch. In case the pressure falls further below 96 kg/cm² starting and stopping motor of standby motor is controlled by pressure switch within the specified limit of 99 – 95 kg/cm² through pressure switch. As per our design at times both pumps (main + standby) may be in operation.

The top of the tank shall be provided with a channel to collect split oil. All split oil shall be channeled to a bottle mounted on the side of the tank.

3.8 ISOLATING VALVE (Device no. 321-1& 2)

2 nos. Ball valve class 900 after the NRV (302IV) of size 65 NB to class 900 to be provided for attending the NRV without stopping the machine in power house. The ball of the valve should be of SS.



3.9 ISOLATING VALVE (Device no. 347)

1 no. Ball valve class 900 after the NRV (302-c) of size 15 NB to be provided for attending the NRV without stopping the machine in power house. The Ball of the valve should be of SS.

3.10 RETURN LINE DUPLEX FILTER (Device no. 365-1, 33-88-b)

- a) Flow rate - **1200 LPM or more**
- b) Liquid - Turbine oil ISO-VG-46
- Viscosity - 37-150 CST
- c) Filtration rate - 40 – 50 microns
- d) Bypass Valve - Required with cracking pressure of 3~5 kg/cm² opened Automatically
- e) Return line pressure - 16 kg/cm²
- f) Clogging Indication- Visual & electrical clogging indicator required and to Operate at a differential of 3~5 kg/cm²
- g) Filter Element - Type of filter material shall be S.S. re-useable type to be used. It should with stand the differential pressure of 10 kg/cm²
- h) Mounting - Floor / side mounted
- i) Inlet & Outlet - **DIN 150 NB, 16 ATA**
- Connection
- j) Pressure drop - **≤ 1 kg/cm² at 1200 LPM**

3.11 CIRCULATING PUMP FOR OIL FILTRATION (device no. 301-D) :-

- a) Number - 1 Nos.
- b) Type - Gear /Vane pump
- c) Rated speed - 1450 rpm
- d) Rotation - Clock wise view from motor side
- e) Delivery pressure - 10 kg/cm²
- f) Suction pressure - (-) 0.4 kg/cm²
- g) Capacity - **100 (+10%,-5%) LPM** as per VDMA std. 24284 Group-II
- h) Medium of liquid - ISO – VG - 46 mineral oil heavy duty
- i) Viscosity range - 37-150 CST
- j) Range of permissible - (-) 10 deg. To (+) 75 deg. C
- temperature
- k) Connection - Delivery: Pipe & Flange type 32 NB, DIN 16 ATA

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3.12 ELECTRICAL MOTOR FOR CIRCULATING PUMP (Device no. 88 MG-D)

Number	-	1 Nos.
Type	-	Totally enclosed fan cooled vertical Flange mounting, Squirrel cage induction motor
Output	-	3.7 kW depends on pump (301IV- A & B) characteristics
Voltage	-	415 V $\pm$ 10% , 50 Hz $\pm$ 5% , 3 phase
Speed	-	1450 rpm
Mounting	-	To suit oil pump (Device No. 301-D)
Insulation class	-	Class-F or better
Temp. raise	-	Should be limited to Class-B at 10 % continuous overload above rated load condition
Efficiency class	-	IE-3

3.13 Pressure Relief Valve (Device no. 322-D)

Set to operate at	-	12 kg/cm ²
Size	-	Bidder to decide.
Type	-	Direct operated spring loaded type

3.14 NON RETURN VALVE (Device No. 302-D)

Type	-	Spring loaded poppet type (Inline mounting / manifold sub plate mounting type)
Cracking Pressure	-	0.4 to 0.5 kg/cm ²
Capacity	-	Capable to cope-up the discharge of jockey pump (100LPM+10%) at a pressure of 10 kg/cm ² with pressure drop (Del P) not more than 2 kg/cm ²
Size	-	Dia 32 or more

3.15 RETURN LINE DUPLEX FILTER (Device no. 365-2, 33-88-b)

a)	Flow rate	-	200 LPM or more
b)	Liquid	-	Turbine oil ISO-VG-46
	Viscosity	-	37-150 CST
c)	Filtration rate	-	10 microns
d)	Bypass Valve	-	Required with cracking pressure of 3~5 kg/cm ² opened Automatically
e)	Working Pressure	-	10 kg/cm ²
f)	Clogging Indication-		Visual & electrical clogging indicator required and to Operate at a differential of 3~5 kg/cm ²
g)	Filter Element	-	Type of filter material shall be S.S. re-useable type to be used. It should with stand the differential pressure of 10 kg/cm ²
h)	Mounting	-	Floor / side mounted

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- i) Inlet & Outlet Connection - **DIN 32 NB, 16 ATA**
- j) Pressure drop - **≤ 1 kg/cm² at 200 LPM**

3.16 WATER COOLED OIL COOLER (Device No. 310)

- (a) Type : S.S."ULTRFLEX" Plate Design type Heat Exchanger
- (b) Oil flow rate : **50 LPM** (+) 10% (-) 5%
- (c) Oil inlet temp. : 40 °C
- (d) Oil outlet temp. : 35 °C
- (e) Water flow rate : 402 LPM
- (f) Water inlet temp. : 25 °C
- (g) Cooler capacity : ≥ 18 kW
- (h) Type of liquid : Turbine oil ISO-VG-46, Spec. Gr. 0.87, Spec. heat 0.5, viscosity 37-150 cst.
- (i) Pr. drop at rated flow : maximum 1.5 kg/cm²
- (j) Design pressure : 10 kg/cm²
- (k) Test pressure : 15 kg/cm²
- (l) Cooler Plate material : Stainless Steel.
- (m) Type of Plates : To be decided by the supplier
- (n) All other material to be mild steel.
- (o) Fastener must be plated one.
- (p) Oil, Inlet / Outlet Connection : **DIN 32 NB, 16 ATA**
- (q) Water, Inlet /Outlet Connection : **DIN 40 NB, 16 ATA (With mating blind flange)**

3.17 AIR BREATHER CUM FILLER TANK MOUNTED (Device N0. 361)

- (a) Capacity of airflow : 2 M³ / Min.
- (b) Filtration rate : 10 microns
- (c) Pressure drop : 0.01 Bar (Clean filter pressure drop)

3.18 OIL LEVEL INDICATOR "DIGITAL TYPE" (Device No. 314IV) WITH LEVEL SWITCHES (Device No. 71 G – 1, 2, 12&16) AND LEVEL TRANSMITTER (71G-15) FOR OIL SUMP TANK

3.18(A) - OIL LEVEL PROBE CUM TRANSMITTER (Capacitance Type)

- a) Measuring range : 0~1500 mm
- b) Probe length : 1500 mm (From mounting surface)

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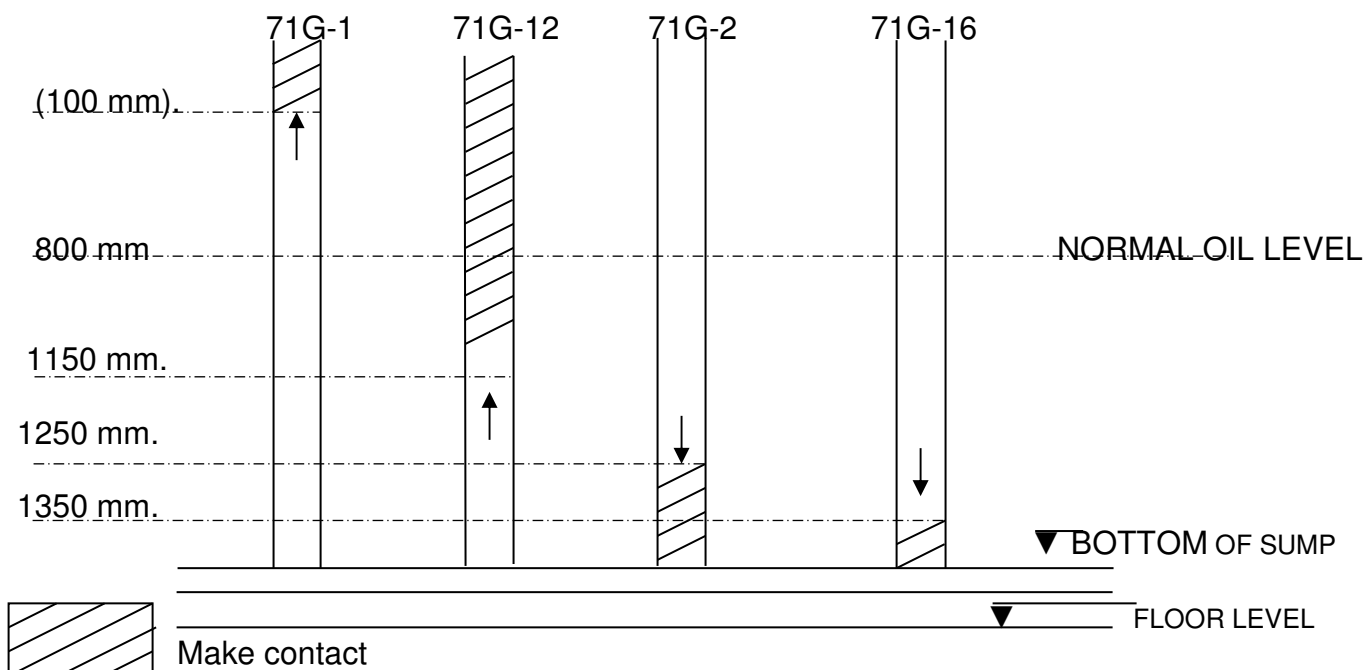
- c) Fully insulated rod type probe having weather proof cast aluminum housing with cable entry
- d) Process connection : To be decided by vendor
- e) Material of probe : PTFE Coated steel / Metallic / Stainless steel
- f) Reference/Grounding Probe : required
- g) Application media : Turbine oil (ISO VG 46)
- h) Medium temperature : -10 to 70 °C
- i) Ambient temperature : -10 to 50 °C
- j) The level controller cum transmitter shall be part of level probe housing.
- k) Output signal : 4 – 20 mA , corresponding to the calibrated span
- l) Accuracy : ± 0.5 % of the calibrated span including linearity, hysteresis & repeatability
- m) Sensor power supply : 24 VDC
- n) Connection : 2 wire system
- o) Protection : IP 65 / IP67

3.18 (B) - DIGITAL INDICATOR CUM POWER SUPPLY UNIT FOR LEVEL PROBE

- a) Display : 4 / 5 digit LED / LCD display
- b) Mounting : Panel mounting type
- c) Input signal : 4 to 20 mA (From level transmitter)
- d) Power output : 24 VDC power supply to level transmitter
- e) Output signal (71G-15) : Separate one no. 4-20 mA output for retransmission
- f) Measuring range : **0 to 1500 mm** [Push buttons for configurations]
- g) Auxiliary power supply : 240 V AC $\pm 10\%$, 50 Hz
- h) Relay output : 4 Nos. (Change over type - SPDT), Potential free
- i) Contact Rating : DC 220 V, 0.5 A & AC 230 V, 5 A.
- j) Oil level switches must operate when oil level change into the direction of the arrow
- k) Accuracy : 0.25 % of FSD
- l) **Setting of level switches:(reading from top surface of the oil sump tank)**

- i) 71G – 1 : 100 mm (closes on rising of oil level)
- ii) 71G – 12 : 900 mm (closes on rising of oil level)
- iii) 71G – 2 : 1100 mm (closes on falling of oil level)
- iv) 71G – 16 : 1150 mm (closes on falling of oil level)

(m) Electrical Terminal connection type : Screw Type wire connection and push on fit type terminal blocks

**SWITCHING DIAGRAM (w.r.t. tank mounting surface) :-****3.19 OIL LEVEL SIGHT GAUGE FOR SUMP TANK AND SS SCALE (Dev. No. 314G-1, 314G-2)**

- 1 set Flush / surface mounted Fluid level gauge over lapping each other so that **complete range of level is visible**.
- Stainless steel graduated scale** for full length of sump tank to be fitted with min. graduation of 5mm (marked in RED at every 100 mm).

**3.20 DIAL TYPE THERMOMETER WITH 2 INDEPENDENT ELECTRICAL CONTACTS
(Device No. 23 G – 6a,b)**

- Dial size : Dia 100 mm
- Measuring range : 0 -100 °C
- Min. graduation : 2 Deg.C
- Switching contact : Magnetic snap action type, 2 number 'NO'(normally open) contacts ,each independently adjustable throughout the range for making contact at set point for alarm & shut down.
- Setting of temperature : (+) 5 Deg. C – (+) 65 Deg. C adjustable.
- Contact rating : Suitable for switching voltage 220 VDC/240 VAC
Switching current 0.6A continuous
- Dielectric strength test : 2000 V for 1 min.
- Installation stem length : 1520 mm from top plate of sump tank
- Capillary length : 3~5 meters (to suit from top of stem to dial)
- Connection : ½" BSP Adjustable screw type fitting (preferably)



k. Accessories : Terminal box built-in type with plugin type connection

3.21 PT 100 DUPLEX RTD (Device no. 23G-8) with suitable Thermowell

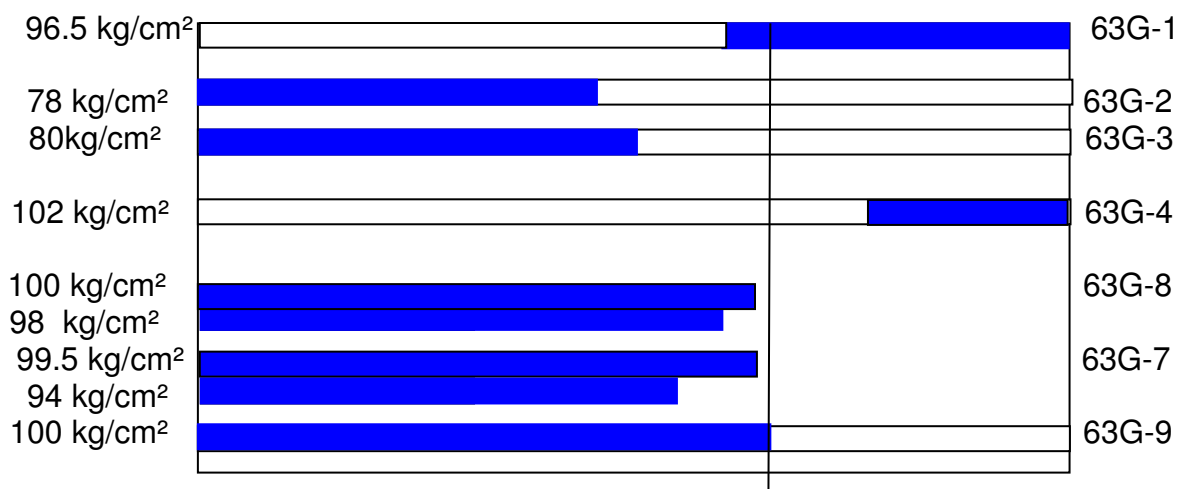
For Technical specification and dimension :Refer Drg.no.22310515001

3.22 PRESSURE SWITCHES (DEVICE NO. 63G-1, 2, 3, 4, 7, 8 & 9) SWITCHING DIAGRAM



Make contact

100 kg/cm² (Max. NWP)



Type : Electronic pressure switch
Display : LED / LCD type
Programming keys : Configuration programming keys
Electronic contacts : 4NO+4NC, 4 Relays with changeover contacts in 2 groups, 240 VAC, 5A & 220VDC, 2A / 0.5A
Terminal connections : Plugin type terminal connection
Switch Delay : Switch on delay [0 to 15 sec. or more]
Max. operating pressure : 120 kg/cm²
Analog output : 4-20 mA
Setting accuracy : 0.5 % FS Max.
Input supply voltage : 22-32 VDC
Connection : 1/4" BSP (F) [Preferably]
Wetted parts : Stainless steel
Mounting : Plate mounting type with vibration pads
Protection class : IP65 / IP 66

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3.23 TECHNICAL SPECIFICATION OF OIL CONTAMINATION SENSOR (Device no. 96G) :

Online contamination sensor is used for monitoring ISO/NAS cleanliness of turbine oil with local display and remote communication

- a) Measured variable - Cleanliness class display as per ISO 4406/NAS 1638
- b) Operating Media - Turbine Oil (ISO VG 46)
- c) Input Voltage - 24 V DC / 230 V AC single phase
- d) Output Signal corresponding - Current , 4 - 20 mA
To cleanliness measured
- e) Electrical Output connection - Cable with Pin Type connector
- f) Operating Temperature Range - - 0° to +70° C
- g) Sensor mounting - as per Manufacturer standard .
- h) Operating Pressure - as per Manufacturer standard
- i) Protection class - IP65 or better
- j) Display LED / LCD display
- k) Wiring - Furnish the wiring diagram with color code along with dimensional drawing / catalog .
- l) Calibration - Item must be calibrated for the operating media
Turbine Oil (ISO VG-46) .

Note : All accessories required for proper functioning of the instrument will be in supplier scope.

3.24 ISOLATING VALVE WITH MINIMESS (Device no.323-1 to 5)

Needle type valve (Size: 3/8" BSP, Class 900) to be provided in the line of pressure gauge and pressure switch with minimeess pipe hose and coupler.

3.25 PRESSURE GAUGE (Device No. 305 & 304)

- (a) Numbers - 2 Nos.
- b) Type : Bourdon tube type with plus/internal dampening device/
Glycerin filled circular dial industrial Gauge with
concentric scale with zero adjustment.
- (b) Size of Dial : Dia 150/160, Flush panel mounting, Back / Bottom entry
- (c) Pr. Measuring Range : 0-20 kg/cm² and 0 ~ 160 kg/cm²



- (d) End connection : 3/8" BSP (Preferably)
(e) Code : Standard type class 1.0
(f) Make : As per enclosed annexure-I
(g) Pressure Gauge shall be connected with mininess pipe & coupler after isolating valve.

Note: Pressure switches & pressure gauges to be connected with mininess pipe & coupler after isolating valve (Device no.323IV).

3.26 DRAIN VALVE (Device no.372)

25 NB class 300 drain ball type valve with metallic plug to be provided at the bottom most position to drain the complete oil of sump tank. Ball of the valve should be of SS.

3.27 OIL PURIFIER CONNECTION (Device no.320)

Two nos. connection, one for oil purifier suction and other for oil purifier return to be provided up to bottom of tank. Size 1" BSP male with blanking cap to connect purifying machine.

3.28 ISOLATING VALVE (DEVICE NO. 355-1~3 & 356)

As per scheme Isolating valve (Ball valve type, 355-1~3 and 356) of 32 **NB** to suit cooler inlet / outlet to PN16 ATA to be provided.

3.29 OIL RELEASE VALVE (Device no. 328)

Oil release valve shall be of Needle valve type 25NB to class 900.

3.30 OIL STRAINER ASSEMBLY (Device No. 360)

One no. partition plate to divide sump in two chambers with strainers (360) with magnets to separate the iron particles. 750 micron S.S. mesh to be provide with a support of Dia 3 mm perforated mesh.

3.31 OTHER CONNECTIONS AND ACCESSORIES:

- One Man- hole (Device No. 344) on front side at lower location of tank (600 mm dia. with suitable oil resistant gasket & Cover)
- Four Lifting lugs suitable for lifting complete weight of assembled power pack with factor of safety 4.

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- Two set of tapping (one set equal to 2 no.1/2" BSP hole & 2 no.3/4" BSP hole) should be provided one set each on opposite side of tank
- One (no.) 150 NB & One (no.) 100 NB Flanged connections to DIN PN16 ATA for spare on side bottom at suitable place
- A set of anchor fastener for foundation to be supplied in loose condition.

3.32 PIPES:

- All pipe sizes are to be designed to cater full flow and velocity of oil shall not be more than 3 m/sec for pressure line and 2 m/sec for drain line (This is for reference). **However, pipe sizes should be same as specified in the control gear diagram.**
- All pressure pipes must be of suitable for 100Kg/cm² and drain pipes for 16Kg/cm².
- Pressure Pipe Flanges drilling conform to DIN Standard PN-100 ATA and Drain pipe flanges to DIN std. PN 16 ATA with full strength mating blind flanges.
- **All Pipes, Flanges & pipe fittings shall be of Steel.**
- All pressure pipes must be hydrostatically pressure tested at 180 kg/cm² and drain pipes to 24 kg/cm² for not less than 30 minutes separately before painting & assy.
- For pipe size less than 25 NB ,seamless tube of suitable pressure is acceptable.

3.33 WIRING:

Terminal box (Protection class of IP65) should be provided for termination of electrical components. All electric components shall be wired up-to terminal block of terminal box with ferrule Nos. as per wiring diagram at suitable location and wiring inter-connection cable shall be routed suitably neat & clean. Terminal box should have atleast 20% extra spare terminals. Sufficient working space must be available all around the terminal blocks inside the terminal box for wiring.

Terminal block: The screw type terminal blocks should be provided and each terminal block should be suitable for connecting 4 sq mm. wire. The insulating material of the terminal blocks shall be polyamide 6.6.

Wire and wiring system:

a) Control circuit:

Multi- strand single core tinned copper conductor unsheathed 660 / 1100V polyvinyl chloride insulated cable - 2.5 mm² for solenoids & 1.5 mm² for instruments.

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- b) Power circuit Three phase**
- | | |
|-------------|--------|
| R - phase | Red |
| Y - phase | Yellow |
| B - phase | Blue |
| N - neutral | Black |
- c) Wire color coding: -**
- | | |
|---------------|-------|
| DC circuit | Gray |
| Earthing wire | Green |

3.34 BHEL MONOGRAM, RATING PLATE, INSTRUCTION PLATE:

- Rating plate (Drawing. No.12210149005 #2) and Instruction plate (Drawing No. 12210149042) will be supplied by the supplier. Drawing will be given to successful bidder.
- **BHEL monogram size 100 to BP7250199013 to be arranged by the supplier.**

3.35 IDENTIFICATION BY METALLIC INSCRIPTION PLATE

Inscription plate of all electrical & mechanical components shall be provided by supplier as per diagram of control gear drawing no. 12000018807 for identification of each component.

4. CLEANING, PAINTING AND PROTECTION

Completed tank to be sand blasted internally and immediately painted with oil resisting paint. **Interior surface of the sump tank shall be given not less than one coat of compatible primer and not less than two coats of white oil proof epoxy paints.** Tentative colour coding for PP set is given in the drg. No. 32210120501 rev.00. Painting requirement should be finalized by our customer during GA drawing approval. Paint thickness shall not be less than 90 micron.

5. PACKING:

Complete assembly shall be packed in a wooden box with silica gel packet & water proof cover(100 Micron polythene sheet) so that water shall not find the way to enter in the equipment and with adequate cushioning material to minimize the movement of the internals and ensure that the equipment is capable of withstanding the transit condition without any damages. Packing list containing items in BOM shall be furnished by supplier before dispatch.

6. DOCUMENTATION:

- 6.1 The supplier shall submit the following documents at the time of offer which shall include the following.
- i) Bill of material along with model code, make, quantity & catalogue, **incomplete offer shall not be acceptable.**
 - ii) Catalogues for the items mentioned in this specification to be submitted by supplier separately along with the offer.

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- iii) Guaranteed technical particulars.
- iv) **List of Deviations:** Supplier to submit list of deviations, if any, from our spec. otherwise it will be understood that the supplier is meeting all the requirements mentioned in our spec.

6.2 The supplier shall submit the following documents after placement of purchase order.

- i) Outline general arrangement drawings showing all the device, overall dimensions, layout, foundation details and bill of material / part list **within 4 weeks of PO** for approval by BHEL / BHEL's customer.
- ii) Pump characteristics curve , Motor data sheet along with cross sectional arrangement drawing of Pump to be submitted for approval from BHEL / BHEL's customer.
After incorporating our comments subsequent revised drawing shall also to be submitted within 1 week of receipt of comments.
- v) **Manufacturing shall only be started after manufacturing clearance / approval of drawings .**

6.3 10-copies of Operation and maintenance manual covering catalogues and Drgs. are to be supplied. In addition to the same soft copy of O & M manual shall also be submitted.

6.4 Test certificates to be supplied covering the following test & basic design data called in the scope of supply and also for all the items covered in spare list.

- 1) Capacity test for oil pumps.
- 2) Setting of relief valve.
- 3) Insulation resistance measurement of motor.
- 4) Power consumption of motor with full load and no load current.
- 5) Gravity test of Sump tank for 24 hours for leakage.
- 7) Setting of Pressure switches and calibration certificate.
- 8) Setting of Level control switches.
- 9) Noise level measurement of Pump-motor set from 1 meter.
- 10) Pressure gauge calibration certificate.
- 11) Dial Thermometer calibration certificate & electrical contact operation.
- 12) TCs / Compliance certificates of raw material and all bought out items.
- 13) Test certificate of sand blasting.
- 14) Material TC (Chemical , Mechanical properties) of sump tank, pipes & flanges

In addition to the hard copy, soft copy above test certificates shall also be submitted.

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7. INSPECTION & TESTING

Inspecting & Testing shall be carried out at vendor's work by BHEL and BHEL's customer as per Customer **APPROVED Q.A. PLAN NO: QA/HT/1097 Rev. 01 DTD. 23.05.2020 ENCLOSED**. Acceptance after testing or waiver of inspection does not absolve the supplier of his responsibility to rectify the equipment in case it does not perform satisfactorily at Hydro site, where it is actually used. Complete Arrangement of P.P.Set will be witnessed as per test procedure supplied by BHEL to successful bidder after placement of order.

8. IDENTIFICATION

Each sump tank must be identified on the top of the panel as titled below, by S.S. name plate , to be engraved and filled black paint. The letter height shall not be less than 50mm.

"P. P. SET FOR GOV AND MIV –UNIT-I" TO UNIT-IV respectively.

W.O. no to be engraved on each rating plate unit wise as follow:

38202X22321 ~ 38205X22321.

Project Name – Arun-III HEP

9. GUARANTEE / WARRANTEE:

The equipment supplied shall be guaranteed / warranted for and 18 months from the date of supply. During the period the supplier shall remain liable for repair/ replacement for any parts that may fail due to manufacturing / material defects at Arun-III HEP site.

10. All fasteners must be zinc passivated and property clause P12.9 / P12.

**11. Table-1 LIST OF SPARES FOR POWER PACK (GOV AND MIV):****QTY. - 1 SET (CONSISTING OF THE FOLLOWING ITEMS)**

SL. NO.	ITEM DESCRIPTION	QUANTITY
1	Isolating valve (device no. 321-1)	2 Nos.
2	Isolating valve (device no. 347)	2 Nos.
3	Isolating valve (device no. 355-2)	2 Nos.
4	Needle valve (device no. 328)	5 Nos.
5	Flow control Valve (device no. 323)	2 Nos.
6	Isolating valve (device no. 372)	5 Nos.
7	Solenoid valve (device no.363-A)	6 Nos.
8	Solenoid Valve (device no. 363-C)	4 Nos.
9	Complete set of all seals & packing	5 set
10	Mechanical Seal of Pump	2 no.
11	Complete Pump (device no 301IV) & Motor (device no 88MIV) in Assembled & tested condition	4 Set
12	Complete Jockey Pump (device no. 301-C) and Motor (Device no.88MG-C)	2 Set
13	Recirculating Pump (device no. 301-D & 88MG-D)	2 Set
14	Ball bearing for pump (device no 301-A)	4 nos.
15	Ball bearing for Motor (device no 88MG-A) (Driving End)	4 nos.
16	Ball bearing for Motor (device no 88MG-A) (Non Driving End)	4 nos.
17	Ball bearing for pump (device no 301-C)	4 nos.
18	Ball bearing for Motor (device no 88MG-C) (Driving End)	4 nos.
19	Ball bearing for Motor (device no 88MG-C) (Non Driving End)	4 nos.
20	Ball bearing for pump (device no 301-D)	4 nos.
21	Ball bearing for Motor (device no 88MG-D) (Driving End)	4 nos.
22	Ball bearing for Motor (device no 88MG-D) (Non Driving End)	4 nos.
23	Unloader valve(device no 306IV) (logic Cartridge valve assy.)	3 Nos.
24	Safety Relief valve (device no 322-A)	3 Nos.
25	Non return Valve (device no. 302-A)	3 Nos.
26	Safety Relief valve (device no 322-C)	3 No.
27	Non return Valve (device no. 302-C)	1 No.
28	Safety Relief valve (322-D)	1 No.
29	Non return Valve (device no. 302-D)	1 No.
30	Oil filter assembly (365)	1 No.
31	Oil filter assembly (365-1)	1 No.
32	Oil filter element – 40/50 Micron (To suit device no. 365IV-1)	2 Nos.
33	Oil filter element -10 micron (to suit device no. 365IV-2)	10 Nos.



34	Level Relay (Level sensor +Level Indicator) (Device no. 314, 71G-15 & 71G-1,2,12&16)	2 Sets
35	Sight Glass gauge (device no. 314-1)	2 Nos.
36	Pressure Gauge (0-16 kg/cm ²) (Device no. 304)	5 Nos.
37	Pressure Gauge (0-160 kg/cm ²) (Device no. 305)	5 Nos.
38	Dial Type Thermometer (Device no. 23G-8)	1 No.
39	Resistance Temperature Detector (Device no. 23G-6)	1 No.

Annexure –I : Instrument and device of P.P.Set

S.No.	Device No.	Description	Specification	Make	Qty
1	313	Oil Reservoir (Sump Tank)	Refer clause no. 3.1	Fabricated by vendor	01
2	301-A & B	Oil triple screw Pump, Vertical Tank Mounted Bracket and Flexible drive coupling	Refer clause no. 3.2	Tushaco Pumps / UT Pumps / Allweiler / Kral / Circor	02
3	88 MG - A&B	Electric Motor 3 Phase	Refer clause no. 3.3	Kirlosker / ABB / Crompton Greaves / NGEF/ Siemens / BBL / Alstom	02
4	301-C	Jockey Pump (Gear/vane)	Refer clause no. 3.4	Yuken/Hydac /Rexroth/Parker/Vickers/Dowty	01
5	88MG-C	Electric Motor	Refer clause no. 3.5	Kirlosker / ABB / Crompton Greaves / NGEF/ Siemens / BBL / Alstom	01
6	301-D	Recirculating Pump (Gear/Vane)	Refer clause no. 3.11	Yuken/Hydac /Rexroth/Parker/Vickers/Dowty	01
7	88MG-D	Electric Motor	Refer clause no. 3.12	Kirlosker / ABB / Crompton Greaves / NGEF/ Siemens / BBL / Alstom	01
Manifold Assy. (For Main and stand By Pump) assembly of device no. 306-A&B , 322-A&B ,363-A&B & 20G-A&B)					
8	306-A&B	Solenoid Controlled Unloader Valve	Refer clause no. 3.6.1	Yuken / Hydac / Bosch Rexroth / Parker / Vickers/Atos	02
9	322-A&B	Pr. Relief Valve (Oil Safety Relief Valve)	Refer clause no. 3.6.1		02
10	363-A&B , 20G-A&B	Solenoid Controlled Direction Control Valve	Refer clause no. 3.6.1		02
11	302-A&B	Non Return Valve (Check Valve)	Refer clause no. 3.6.2	Yuken / Hydac / Bosch Rexroth / L&T / Audco / Vickers / MHA Zentgraf	02
12	321-1&2	Isolating valve	Refer clause no. 3.8	Hydac /Yuken / Rexroth / L&T /Audco / MHA Zentgraf	02



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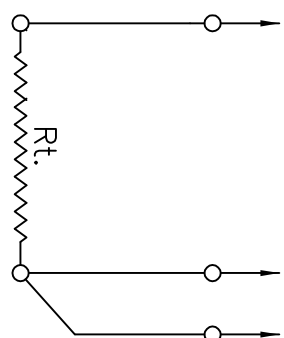
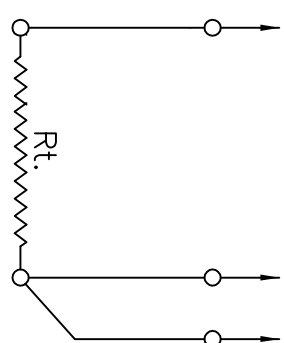
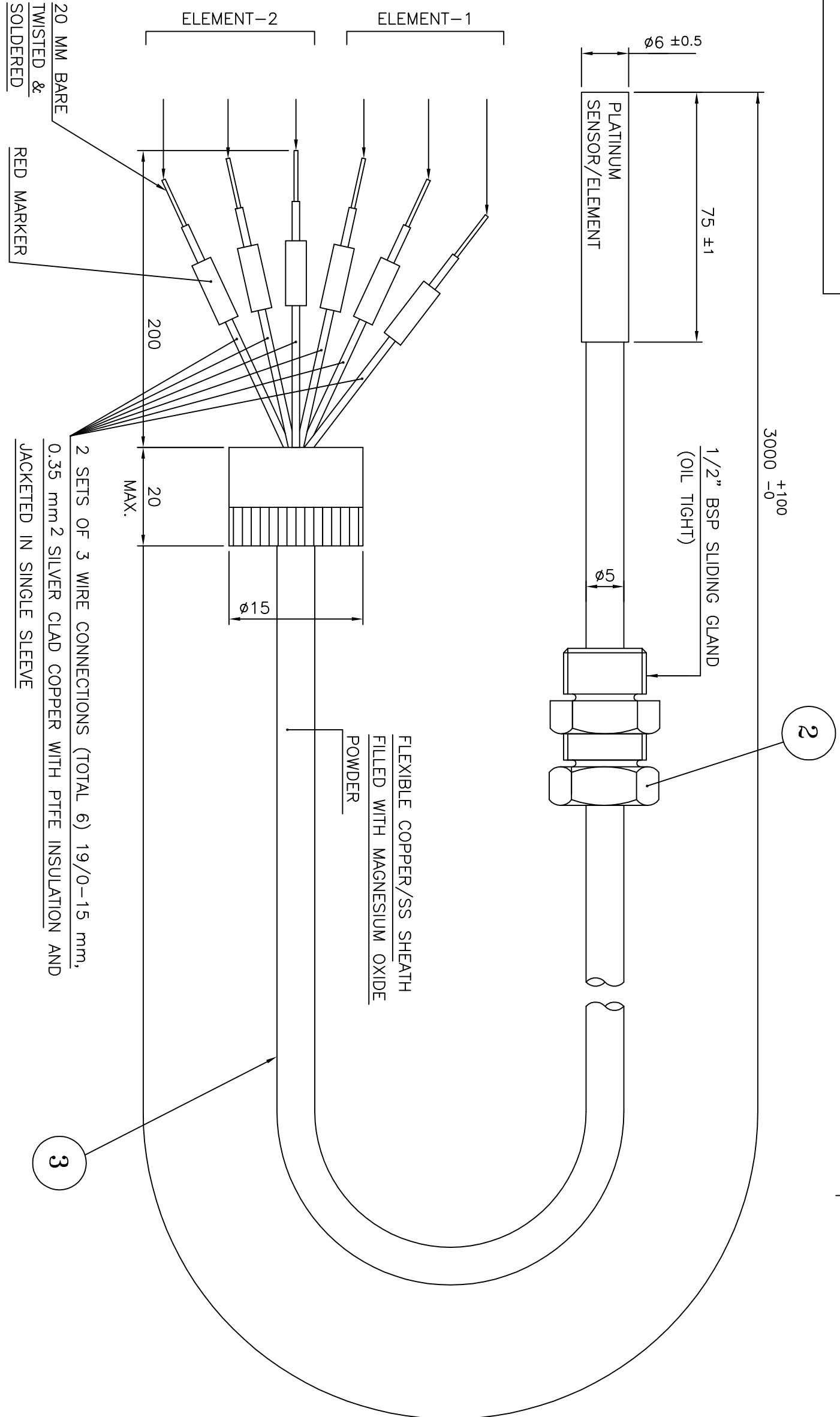
13	347	Isolating valve	Refer clause no. 3.9		01
Manifold assembly for Jockey Pump assembly of device no. 363-C , 20G-C , 322-C & 302-C					
14	363-C , 20G-C	Solenoid Operated Valve	Refer clause no. 3.7.2	Yuken / Hydac / Bosch Rexroth / Parker / Vickers	01
15	322-C	Pr. Relief Valve (Oil Safety Relief Valve)	Refer clause no. 3.7.3		01
16	302-C	Non Return Valve	Refer clause no. 3.7.1	Hydac /Yuken / Rexroth / L&T /Audco / MHA Zentgraf	01
17	322-D	Pr. Relief Valve (Oil Safety Relief Valve)	Refer clause no. 3.13	Yuken / Hydac / Bosch Rexroth / Parker / Vickers	01
18	302PV-D	Non Return Valve	Refer clause no. 3.14	Hydac /Yuken / Rexroth / L&T /Audco / MHA Zentgraf	01
19	365PV-1 , 365PV- 2	Return Line Filter	Refer clause no. 3.10 & 3.15	Hydac / Bosch Rexroth / Internorman / EPE / Pall / Vickers	02
20	33-88b	Electrical Clogging Indicator			02
21	310	Water cooled oil cooler	Refer clause no. 3.16	Alfa Laval/GEA Ecoflex/Tranter/Funke	01
22	361	Air Breather Cum Filler Tank Mounted	Refer clause no. 3.17	Rexroth / Stauff / Hydac / Yuken	01
23	314, 71G-15, 71G - 1,71G -2 , 71G - 12 & 71G-16	Oil level sensor probe cum transmitter Digital level indicator cum level controller	Refer clause no. 3.18	Vega / Hydac / Nivelco / Rexroth / E+H / Emerson process / Magnetrol	1 Set
24	314G - 1	Oil Level Sight Gauge	Refer clause no. 3.19	Hydac / Stuff / Rexroth / Yuken	1 Set
25	23G-6 a,b	Dial Type Thermometer with stem length, capillary,2 electrical contacts	Refer clause no. 3.20	Ashcroft / Budenberg / Kobold / Wika	01
26	63 G- 1,2,3,4,7 8 & 9	Electronic Pressure. Switch (4 set point)	Refer clause no. 3.22	Hydac / Ashcraft / Bosch Rexroth / Wika / Barksdale	03
27	23G-8	Resistance Temperature detector	Refer clause no. 3.21	M/s Detriv Instrumentation /Pyroelectric /Tempson/Ephyness/ELEIND Engineering/Process control/Jindal Electronics	1 Set
28	96G	Oil Contamination sensor along with accessories	Refer clause no.3.23	--	1 Set
29	323	Needle valves	Refer clause no. 3.24	Hydac /Yuken / Rexroth / L&T /Audco / MHA Zentgraf	03
30	305	Pressure Gauge	Refer clause no. 3.25	Ashcroft / Wika / Budenberg / Kobold	01
31	304	Pressure Gauge			02
32	372	Drain Valve (For tank drain)	Refer clause no. 3.26	Hydac /Yuken / Rexroth / L&T /Audco / MHA Zentgraf	01
33	320	Oil Purifier Connections	Refer clause no.	Fabricated by vendor	02

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			3.27		
34	355-1~3 & 356	Isolating Valve	Refer clause no. 3.28	Hydac/Yuken/Rexroth/L&T (Audco)/MHA Zentagraf	01
35	328	Oil Release Valve (Needle Valve)	Refer clause no. 3.29		01
36	-	Electrical Terminal Box ,	Refer clause no. 3.33	<u>Hencel/Rittal/Neptune/Schenider</u>	1 Set
37		Terminal Blocks		Elemex/Connectwell/Wago/ Phoenix/WiedMuller	1 set
38	360-1,	Oil Strainer Assembly fitted with Magnet	Refer clause no. 3.30	Fabricated by vendor	1 no.
39	-	Anchor Fastener with bolt & nut	Refer clause no. 3.31		6 Set
40	314PV-2	SS Graduated Scale	Refer clause no. 3.19		1 No.
41	-	BHEL Logo, Circuit plate, Rating plate and Identification plate	Refer clause no. 3.34		1 Set

NOTE:

- 1. ALL THE MAKES OF THE INSTRUMENTS AND DEVICES OF THE ITEMS OFFERED SHALL REQUIRE END CUSTOMER APPROVAL.**
- 2. THE ITEM OFFERED BY THE VENDOR SHOULD BE STANDARD CATALOGUE ITEM OF PROVEN DESIGN .**
- 3. THE ITEMS BEING OFFERED SHOULD BE IN SUCCESSFUL OPERATION IN ANY OF THE HYDRO POWER HOUSE IN INDIA/ ABROAD.**
- 4. BHEL RESERVES THE RIGHT TO ASK FOR DOCUMENTARY EVIDENCE IN SUPPORT OF THE SAME.**



3-WIRE CONNECTIONS (ELEMENT-1)

3-WIRE CONNECTIONS (ELEMENT-2)

TECHNICAL REQUIREMENTS:-

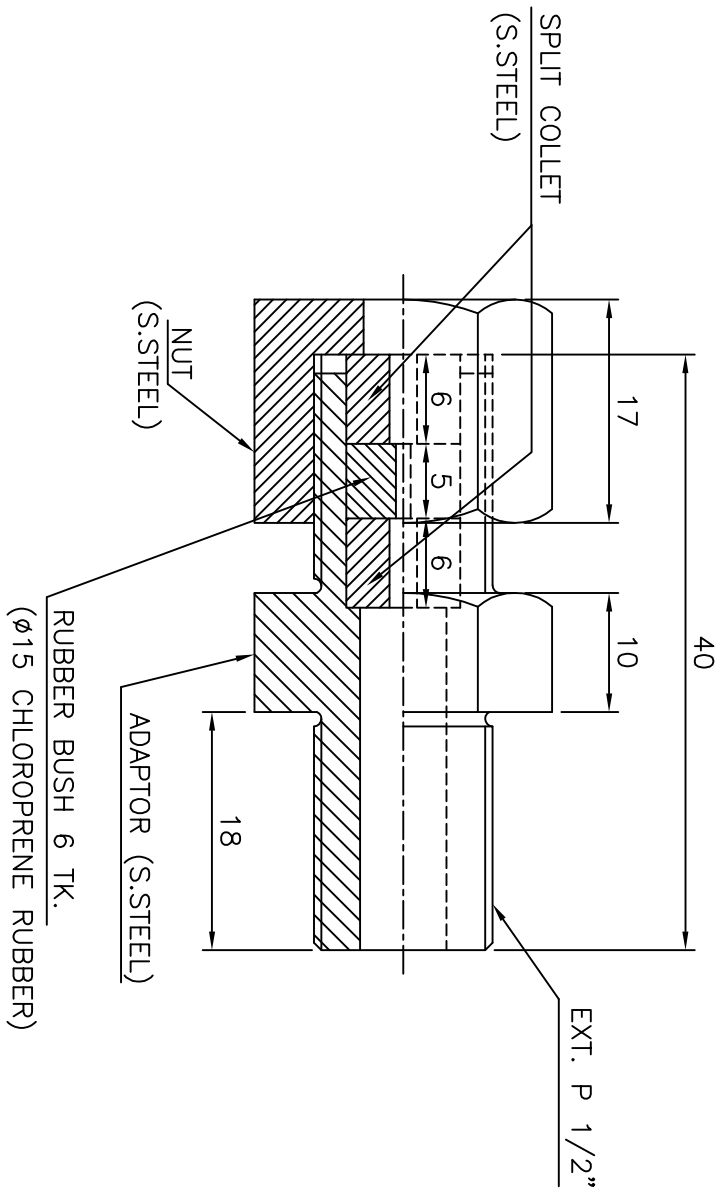
1. RTD TO BEAR A LABEL GIVING R₀, R₁₀₀ AND LEAD RESISTANCE WITH CORRESPONDING TEMPERATURE FOR EACH ELEMENT.
2. RTD TO BE SUPPLIED WITH SLIDING OIL TIGHT GLAND NUT
3. FOLLOWING TESTS SHALL BE CONDUCTED IN LINE WITH IS 2848 AT SUPPLIERS WORKS & 3 COPIES OF TEST CERTIFICATES FURNISHED TO BHEL.
- 3.1 ROUTINE TESTS ON EACH RTD. AS PER CLAUSE 9
 - 3.1.1 RESISTANCE VALUE MEASUREMENT AT 0° & 100°C.
 - 3.1.2 LEAD RESISTANCE MEASUREMENT.
 - 3.1.3 INSULATION RESISTANCE MEASUREMENT OF EACH ELEMENT AND BETWEEN THE ELEMENTS.
- 3.2 TYPE TESTS ON 5% RTDS IN EACH ORDER AS PER CLAUSE 8.0 OF IS:2848.

1) ASSY.

SPECIFICATIONS

TYPE	:-	PT-100, DUPLEX TYPE
R/T RELATION SHIP	:-	CONFORMING TO IS 2848 CLASS 'B'
TEMPERATURE RANGE	:-	0°-100°C
RESISTANCE AT 0°C	:-	100 ±0.12 OHMS
RESISTANCE AT 100°C	:-	138.5 ±0.3 OHMS
FUNDAMENTAL INTERVAL	:-	38.5 OHMS

TEMP: °C	R ¹ OHMS ABS	TOLERANCE
0	100	±0.12
10	103.90	
20	107.79	
30	111.67	
40	115.54	
50	119.40	
60	123.24	
70	127.07	
80	130.89	
90	134.70	
100	138.50	±0.3



DETAILS OF GLAND NUT IT.-2

28 ———> CARD TYPE-3										28 ———> CARD TYPE-1										28 ———> CARD TYPE-2									
VAR.00										VAR.00										VAR.00									
REMARKS										DESCRIPTION										DRAWING NO.									
VAR. IND.										ITEM IND.										STD									
001										PT 100 DUPLEX RTD										C-1									
001										GLAND NUT-EXT P 1/2										A-3									
BL9073516498										001 DUPLEX RTD ASSY.										B-2									
59 64 65 (TYPED ITEM) 75 78 79 25 27 29										58 59 60										77 29 31 34 45 55 56 58 65 72									
ITND.										MATL. CODE										A 57 UNIT W.T.									
VAR.										MATL. SPECN.										QTY.									
32 33 34 35 36 37 38 39 40 41										42 43 44 45 46 47 48 49 50 51										52 53 54 55 56 57 58 59 60 61									

REV.	DATE	REV.	DATE
	ALTERED		ALTERED
	CHECKED		CHECKED
	APPROVED		APPROVED

REV.	DATE	ALTERED	DEPT/HT	325.000001404	325.000001404
		CHECKED	UNPTOL. DIMS. GR.		
		APPROVED			

उत्पात SCALE	भार (कि.ग्रा.) WEIGHT(K.G.)	असेम्ब्ली का संदर्भ REF. TO ASSY. DRG.	माद क्र. ITEM NO.	माद संख्या NO. OF ITEM
NA	NA	NA	NA	NA

[illegible]

शीर्षक/ TITLE	Pt-100 DUPLEX I
TEMPERATURE DE	
(PP SET)	

RESISTANCE	इंजीं ग. / DRAWING NO.	प्रत.
INSPECTOR	2 23105 150 01	REV. 00
	पृष्ठ क. / SHT. NO. 01	पृष्ठों की संख्या / NO. OF SHT. 01



to be clearly visible and shall give the device number, as mentioned in the module wiring drawings.

1.8.9 Motors

All electric motors for driving various equipments shall conform to relevant standards viz. IEC, BS or IS as applicable.

The motor rating, torque characteristics, speed etc. shall be selected to suit the duty requirements.

Type of starter for motors shall be duly approved by the purchaser during detailed engineering. The detailed design calculation for selection of type of starters is to be submitted for approval. The priority for type of starters shall be in the following order:

1. Variable frequency drive
2. Soft starter
3. Star delta/ auto –transformer
4. Direct on-line starter

The enclosure of each motor shall be of the type best suited for the service conditions of the motor

The motor insulation shall be resistant to moisture, oil or oil vapor and the motors in general shall be so designed as to suit the tropical climate. Varnished cambric or glass insulation class F shall be used for connection from the windings to the terminals.

The terminal box shall be closed conduit box type conveniently located, and shall have means for terminating the external wiring for outdoor use. The motor terminals shall be of the stud type totally enclosed. Eye bolts or lugs shall be provided for lifting.

Space heaters to avoid condensation shall also be provided.

Special type of motors, not adequately covered by these specifications, shall be offered for any special application, but these shall be subject to the approval of purchaser.

1.8.10 Construction power

Contractor shall make arrangement for the construction power for ensuring uninterrupted execution of the works. Suitable no. of DG sets shall be installed at strategic locations for extending uninterrupted power supplies to various sites.

