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2. SCOPE OF SUPPLY:

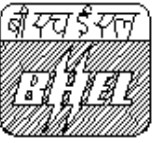
- Completely assembled hydraulic control panel for BFV as per hydraulic schematic diagram drawing no. 22170118801 Rev. 00 and GA drawing no. 02170118801 Rev. 00 (Drg. Enclosed).

LIST OF INSTRUMENTS AND DEVICE MOUNTED ON HYDRAULIC CONTROL PANEL FOR BFV:

S NO.	DEVICE NO.	DESCRIPTION	SPECIFICATION	QTY	MAKE
1	556PV, 557PV, 20-24Φ, 20-24C, 580PV-1	Solenoid Pilot operated directional control valve with manifold	Refer clause no. 3.2	1 No.	Bosch Rexroth / Yuken / Hydac / Eaton
2	564PV, 20-25Φ, 20-25C, 580PV-2	Solenoid Valve of Size 10 along with manifold	Refer clause no. 3.1	1 No.	
3	581PV, 33-88PVC	Duplex Pressure Filter with clogging indicator	Refer clause no. 3.3	1 No.	Hydac / Rexroth / Internorman / EPE / Pall / Vickers
4	559PV & 589PV	Pressure Gauge for water	Refer clause no. 3.6	2 Nos.	Ashcroft / Wika / Budenberg / Kobold
5	569PV	Pressure Gauge for oil	Refer clause no. 3.6	1 No.	
6	63W-4a & 63W-4b	Differential Pressure Switch	Refer clause no. 3.4	2 Nos.	Ashcraft/ Indfoss/Switzer / Hydac / Bosch Rexroth / Wika/Mass / Barksdale
7	63W-14	Pressure Transmitter for oil	Refer clause no. 3.5	1 No.	E&H / Fisher Rosemount / ABB / Yokogawa / Honeywell
8	63W-11	Pressure Transmitter for water	Refer clause no. 3.5	1 No.	
9	598PV-1 ,598PV-2	Isolating ball Valves	Refer clause no. 3.8	2 Nos.	Hydac /Yuken / Rexroth / L&T /Audco / MHA Zentgraf
10	323PV-1 ~9	Isolating needle valve	Refer clause no. 3.7	9 Nos.	
11	580 PV, 363aPV-1, 363aPV-2, 20-27C	Emergency closing manifold along with Solenoid valve and Logic cartridge valve	Refer clause no. 3.9	1 Set	Bosch Rexroth / Yuken / Hydac /Eaton
12		Terminal Box	Refer clause no. 3.11	1 Set	[Hencel / Rittal / Neptune/ Schneider (For Terminal Box)] [Elmex / Connectwell / Wago / Phoenix / Weid Muller (for Terminal blocks)]
13		LED type lamps (2 Nos.), Door switches (2 Nos., 5 pin Switch & socket (1 No) and MCB (1 No) for AC supply		1 Set	Reputed

Note:

- Vendor has to use all the above instruments and devices from their manufacturing range only, if they are suiting to our technical specification.
 - All the above makes of the instruments and devices shall require end customer approval.
- FOR LIST OF SPARES REFER ANNEXURE – I at page no. 12 of 12

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3. TECHNICAL SPECIFICATION:-

3.1) MANIFOLD ASSEMBLY FOR BFV (580PV-2):

Manifold assy. consists of 4 ways, 2 positions, Solenoid operated, detented spool, directional control valves with manual override facility and general specification given below.

A. SPECIFICATION:

1. Valve size : $\phi 10$
2. Max. Operating pressure : 100 kg/cm^2
3. Flow rate : 80 LPM
4. Working media/fluid : Turbine oil ISO-VG-46
5. Working temperature : (-) 20° to (+) 60°
6. Solenoid operated voltage : $240 \pm 10\%$ VAC continuously rated
7. Solenoid electrical connection : Plugin connector with LED indicator light
8. Humidity in power house : 80 – 95%
9. Mounting conforms to : DIN 24340 Form A10
10. Solenoid valve should have manual overriding facility.
11. Solenoid valve should be mounted on the manifold (device no. 580PV-2) and P,T,A and B connections should be taken out from side of the manifold.

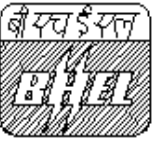
B. IDENTIFICATION:

On the manifold where the valve to be mounted and shall be provided with inscription plates, to identify the solenoid function of valve as follows.

Sl. No.	Description	Valve No.	Solenoid No.	
1	Bypass Valve	564PV	20-25 Φ	20-25C

3.2) SOLENOID PILOT OPERATED DIRECTIONAL CONTROL VALVE 556PV & 557PV WITH SOLENOID 20-24 ϕ & 20-24C

4 ways, 2 positions, Solenoid pilot operated Directional Control Valve for BFV operation. The pilot of the distributing valve shall have detented spool with Manual over-ride facility. The main distributing valve shall be slave to pilot valve under the solenoids control & shall have choke plate for meter in or out control, placed between pilot & main valve. **The valve shall be supplied with manifold (580PV-1) mounted and 'P, A & B' connection must be 50 NB flange connection of PN 100 ATA & 'T' connection must be 50 NB flange connection of PN 16 ATA on the side of manifold. Bottom connection is not acceptable. The pilot valve shall have external pilot supply & external pilot drain.**

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A. HYDRAULIC SYMBOL:

COMBINED HYDRAULIC SYMBOL OF MAIN & SOLENOID OPERATED PILOT VALVES (See Fig-1).

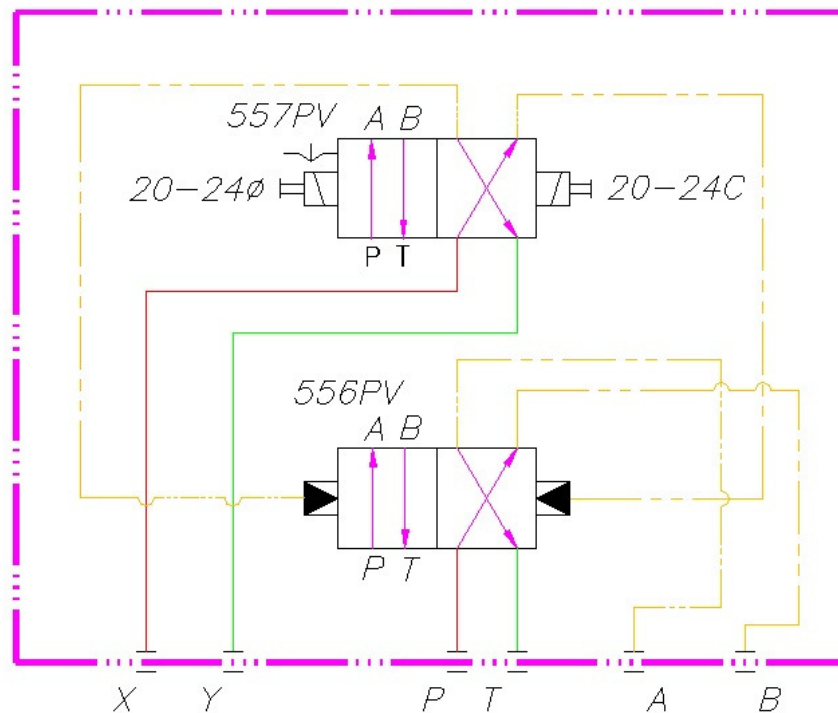
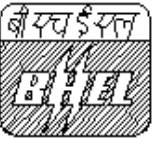


FIGURE-1

B. MAIN VALVE (556PV):

1. Capacity = **300 LPM or More**
2. Max. Operating Pressure = 100 kg/cm^2
3. Pressure drop at 250 LPM = Not more than 4 kg/cm^2
4. Size of valve = Dia **25 mm**
5. Manifold = mounting of valve conforms to **DIN 24340 FORM A-25**,
have flange Connection of P, A & B 50 NB 100 ATA & T will
be 50 NB 16 ATA

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C. PILOT VALVE (557PV):

This is a 4 ways, 2 positions, Solenoid operated, detented spool, valve (557PV) with manual over-ride facility, for the main valve (556PV) mentioned above.

1. Valve size = $\phi 6$
2. Max. Operating Pressure = 100 kg/cm²
3. Operating medium = Turbine oil to ISO VG-46
4. Capacity of the valve = approx. 40 LPM
5. Manual over-ride device = required
7. Solenoid type = Wet type (Oil immersed)
8. Insulation to DIN 40050 = IP 65 or better
9. Duty = Continuous
10. Solenoid supply = 240 $\pm$ 10% VAC
11. Electrical connector = Large angled plug to DIN 43050 with LED light indicator
12. Seal material = VITON
13. The above to be identified as **557PV**
14. The solenoids are to be marked / inscribed with (20-24 ϕ) & (20-24C) for parallel & cross operation respectively.

D. PILOT CHOKE ADJUSTMENT PLATE:

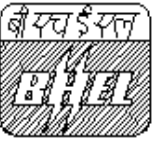
A sandwich Choke plate between Pilot & Main is required for meter in & out control. This plate acts as a time adjuster for operating the main valve faster / slower.

3.3) HIGH PRESSURE DUPLEX OIL FILTER (DEVICE NO. 581PV, 33-88PVC):

In line high pressure Duplex Oil Filter for BFV hydraulic control panel is required. This filter is used in the pressure line to supply the clean oil for the operation of solenoid operated direction control valve assembly and pilot line of solenoid pilot operated main distributing valve for BFV operation.

Further detail specifications are below:

- a) Flow rate of oil : 56 LPM
- b) Max. Operating pressure : 120 Kg/cm²
- c) Medium / Liquid : Turbine oil ISO-VG- 46
- d) Specific gravity : 0.87
- e) Filtration : 25 micron
- f) Operating temperature : (-20)^o C to (+) 80^o C
- g) Clean ΔP : ≤ 1.0 Kg/cm² at 56 LPM
- h) Bypass system : required
- i) Inlet / outlet Connection : Bidder to decide

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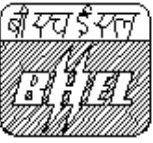
- j) Mounting : line mounted vertically
- k) Clogging indicator : Combine visual / electrical clogging indicator is required with SPDT contact for alarm and annunciation. Operating voltage to be mentioned by supplier (0-240 VAC preferably)
- l) Diff. Pressure for clogging indicator actuation : 3~5 kg/cm²
- m) Filter element : It should be reusable type and should withstand the differential pressure of 30 kg / cm².

3.4) PRESSURE SWITCH (63W-4a, 4b):

- a) Enclosure : Weatherproof to IP 32 or better
- b) Type : Dual input differential pressure switch
- c) Maximum pressure : 20 Bar
- d) Pressure setting range : 0.5 to 4.0 Bar
- e) Differential : Fixed (Between 0.2 to 0.5 Bar) / Adjustable (Between 0.2 to 0.5 bar)
- f) Sensing element : Stainless steel / Non corrosive bellows
- g) Wetted parts : Stainless steel / Non corrosive
- h) Switching contact : 1 No. changeover contact (SPDT type)
- i) Contact rating : 5A / 240 VAC , 0.2 A / 220 VDC
- j) Accuracy : ± 5.0 % of FSR
- k) Repeatability : ± 2.0 % of FSR
- l) Process connection : Vendor to decide (Preferably 3/8" BSP (M))

3.5) PRESSURE TRANSMITTER (DEVICE NO. 63W-11, 63W-14):

- 1. Type : Gauge type and smart type
- 2. Input Power Supply : 24 V DC
- 3. Connection : 2 wire diagram
- 4. Output Signal : 4-20 mA DC
Suitable for electrical load of minimum 500 ohm
- 5. Display : 4 digit side display (LCD) ,Diagnostics cum calibration display And operating keypad required for changing configuration
- 6. Accuracy : $\pm 0.5\%$ of the calibrated span including linearity ,hysteresis & repeatability
- 7. Process Connection : Vendor to decide (preferably 1/2 NPT (F))
- 8. Device No. 63W-11 : Range 0 to 40 kg/cm²
- 9. Device No. 63W-14 : Range 0 to 160 kg/cm²
- 10. Electronic housing : Aluminum alloy with glass indicator for display system
- 11. Process connection : SS material

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3.6) PRESSURE GAUGE (DEVICE NO. 559PV, 589PV, 569PV):

Pressure Gauge shall be of circular dial, flush type panel mounting type with back entry process connection, size 150 / 160 mm having accuracy of $\pm 1\%$ FSD, internal dampening / glycerin filled.

Device No. : 559PV – Range: 0 to 40 kg/cm²

Device No. : 589PV – Range: 0 to 40 kg/cm²

Device No. : 569PV – Range: 0 to 160 kg/cm²

3.7) ISOLATING NEEDLE VALVE FOR PR. GAUGE AND PR. SWITCH (323PV1 ~ 9):

All pressure gauges, pressure switches and pressure transmitters shall be connected with minimess hose , coupling and needle type isolating valve. The valve size should be of 3/8 “BSP and of class 900.

3.8) ISOLATING VALVE FOR DUPLEX FILTER (598PV-1 & 2)

Duplex filter shall be connected with ball valve type isolating valve. The valve size should be of 20 NB and of class 900. The material of the ball should be of SS.

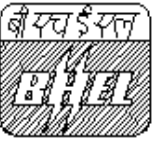
3.9) MANIFOLD ASSEMBLY FOR EMERGENCY CLOSING (580PV)

Manifold assy. consists of 4 ways, 2 positions, Solenoid operated, detented spool, directional control valve with manual override facility and Logic cartridge valves as per hydraulic schematic diagram.

Solenoid valve and logic cartridge valves should be installed on the manifold and the ports / flange connections on the manifold should be as per hydraulic schematic drawing.

A1) Solenoid valve (Device No 564PV-1):

1. Valve size : $\phi 6$
2. Max. Operating pressure : 100 kg/cm²
3. Flow rate : 40 LPM
4. Working media/fluid : Turbine oil ISO-VG-46
5. Working temperature : (-) 20° to (+) 60°
6. Solenoid operated voltage : 240 $\pm$ 10%VAC continuously rated
7. Solenoid electrical connection : Plugin connector with LED indicator light
8. Humidity in power house : 80 – 95%
9. Mounting conforms to : DIN 24340 Form A6
10. Solenoid valve should have manual overriding facility.
11. Solenoid valve should be mounted on the manifold (device no. 580PV) and connections should be on manifold as per schematic diagram.

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A2) Cartridge valve (Device no. 363aPV-1, 363aPV-2)):

- Discharge capacity - 300 LPM + 10%
- Type - Spring loaded poppet type without cushion
- Size - $\varnothing 25$
- Oil flow: For both directions (A – B and B – A) as per our hydraulic schematic

3.10) PIPES AND FITTINGS:

- 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 drawing.
- 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 / blank flanges.
- All Pipes, Flanges & pipe fittings shall be of Stainless 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.

3.11) TERMINAL BOX & TERMINAL BLOCKS AND 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.

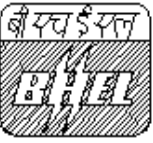
Wire and wiring system:

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.

4. IDENTIFICATION:

Valves to be identified with a device number as shown in the schematic drawing on individual item at appropriate place by punching or affixing metallic inscription.

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5. TESTING:

- i) Functional testing of cabinet should be done as per drawing & test procedure at working pressure with test servo motor at supplier works in witness of BHEL Engr. / as per approved QAP & as per BHEL Test Procedure.
- ii) All Oil pipes to be tested separately outside cabinet before assy. at test pressure of 180 Kg/cm² for minimum 30 minutes. All water pipes to be tested separately outside cabinet before assy. at test pressure of 20 Kg/cm² for minimum 30 minutes.

The test at manufacturer works shall include electrical, mechanical and hydraulic functional tests in accordance with the appropriate clause of statutory regulation, relevant codes & standards and in addition any tests called for OWNER / PURCHASER to ensure that cabinet being supplied fulfill the requirement of specifications. The supplier shall carry out all the shop tests as called in the specification and drawing.

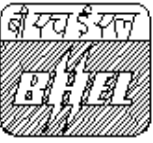
6. PAINTING & PROTECTION:

Painting requirement should be finalized by our customer during GA drawing approval. Tentative color-coding is given in the schematic drawing. Finish paint thickness shall not be less than 90 micron.

7. DOCUMENTAION:

7.1) ALONG WITH THE OFFER:

- a) Catalogues and guaranteed technical particulars.
- b) Catalogue of each BOM items shall be supplied with full technical details along with the offer, otherwise offer will be treated as incomplete and offer will be liable to reject.
- c) Deviation (if any): Supplier to clearly list out deviation otherwise it'll be understood that he supplier is meeting all technical requirements mentioned in this purchase specification.
- d) Vendor has to submit the credentials with following documents.
 - i. Organizational infrastructure
 - ii. Manufacturing and testing facilities
 - iii. Ranges of products offered
 - iv. List of past supplies
 - v. Performance certificates from end users and completion certificates
 - vi. Availability of after sales services in India
- e) Documents listed above in sl. no. 'd' of documentation are required by our customer (PHPA-II). During technical scrutiny if any other documents are required by our customer then same to be submitted by the vendor. Failure to submit the same may lead to rejection of the offer.

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7.2) AFTER AWARD OF CONTRACT:

The supplier shall submit the documents / drawings within 8 weeks after award of Purchase Order (PO), which shall include the following:

- Outline general arrangement drawing of the panel showing all the devices, overall Dimensions, layout and foundation details.
Subsequent revised drawings (after comments from BHEL / customer) also to be submitted within 2 weeks by incorporating our comments to avoid delay.
- Wiring diagram of the panel

7.3) 10 copies of Operation and maintenance manual covering catalogue and Drawings are to be supplied within one month of dispatch. In addition, to this soft copy of the O & M manual to be submitted.

8. INSPECTION REQUIREMENT & TEST CERTIFICATE

Supplier should provide all the necessary facilities required for testing / inspection of components / sub-assemblies to BHEL engineers and their customer engineers at their works.

- Power pack suitable for 120 kg / cm²
- Test servomotor
- Power supply: 24 VDC, 240 VAC
- Multimeter
- Test Pr. Gauge

Three copies of test certificates with respect to following are required. BHEL P.O.No. should be mentioned in each test certificates.

- Bought out items.
- Hydraulic test of components like pipes junction blocks as per drawings.
- Calibration certificate of each instrument used in the assembly and testing.
- Gaurentee certificate
- Compliance certificate

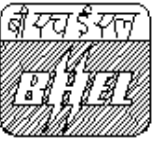
The testing of cabinet to be inspected by BHEL engineers at suppliers works before dispatch for which supplier may inform purchaser in advance (12 days advance notice for inspection).

Supplier to follow the specification & drawings and inspecting engineer should indicate the conformance in his remarks on test report.

9. PACKING INSTRUCTION:

Before putting BFV Hydraulic Control cabinet into wooden box, Cabinet shall be entirely covered with polyethylene sheet of at least 100 microns thickness after placing adequate quantity if silica gel packet in a cotton in a cotton bag. Front side of cabinet shall be properly, covered by polyethylene air bubble film / thermocol sheet of adequate thickness to avoid damages of instrument s mounted in the front side. Wooden box must be reusable type.

Polyethylene sheet of at least 100 microns thickness shall be laid over the base of polyethylene coated bitumen Hessian craft paper. Four sides shall be lined from inside by polyethylene coated bitumen Hessian craft paper. In case jointing is unavoidable, then it should be overlapped by approximately 200mm length. Empty space in the box shall filled with adequate

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cushioning material wherever necessary i.e. thermocol piece, wood wool etc. to avoid movement and shocks. A polyethylene sheet of at least 100 microns thick shall project appropriately 150mm on all side of the top surface.

The following details are to be marked on the packing cases:

- i) Address of consignee.
- ii) P.O. No.
- iii) Description of item
- iv) Case No.
- v) Net weight
- vi) Gross weight
- vii) Dimension of box
- viii) Mark shown. Upright position
- ix) Mark showing sling position wherever necessary
- x) Mark showing umbrella (for showing storage)

10. **GUARANTEE / WARANTEE:**

The equipment supplied shall be guaranteed for a period of 18 months from the date of supply. During the guarantee period the supplier shall remain liable for repair / replacement for any that may fail due to manufacturing / material defects by attending the same to Punatsangchhu-II (Bhutan). Acceptance or waiver of inspection does not absolve the supplier of his responsibility to rectify the equipment in case it does not perform satisfactorily at site where in it is actually used.

11. **STORAGE AND HANDLING:**

Supplier should indicate the method of storage & handling instruction to avoid any damage and safe operation of the system. If any special precaution is required for handling the system it should be clearly indicated in the instruction plate as "CAUTION".

12. **IDENTIFICATION:** Cabinet shall be identified with following inside the cabinet door.

TYPE OF TURBINE		FRANCIS	
NORMAL WORKING PRESSURE		100 Kg/cm ² .	
WORK-ORDER NO.	32001X21117	PUNATSANGCHHU-II	SR.NO.1
	39003X21117	PUNATSANGCHHU-II	SR.NO. 2
	39005X21117	PUNATSANGCHHU-II	SR. NO. 3
YEAR		AS APPLICABLE	

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ANNEXURE – I**LIST OF SPARES:**

SL.NO.	DESCRIPTION OF ITEM	QTY.
1.	Pressure gauge (Device No. 559PV)	6 Nos
2.	Pressure gauge (Device No. 569PV)	6 Nos.
3.	Solenoid valve (Device No. 557PV)	1 No.
4.	Solenoid valve (Device No. 564PV)	1 No.
5.	Solenoid valve (Device No. 564PV-1)	1 No.
6.	Logic cartridge valve assembly (Device No. 363aPV-1)	1 No.
7.	Filter element to suit duplex filter (Device No. 581PV)	3 Nos.
8.	Isolating valve	
8.1.	Needle valve (Device No. 323PV-1)	2 Nos.
8.2.	Ball valve (Device No. 598PV-1)	2 Nos.
9.	Set of seal and gasket used in pipe, flange fitting and solenoid valves [1 Set = 2 Nos. of each type]	2 Set
10.	Pressure Switch (Device No. 63W-4a)	3 Nos.
11.	Pressure Transmitter (63W-11)	1 No.
12.	Pressure Transmitter (63W-14)	1 No.