

SPECIFICATION OF LPG COMPRESSOR (65CFM)

A. GENERAL

Service	:	LPG
No. of compressors	:	2 Nos.(1-operating, 1-standby)
Code of construction	:	API 618
Vol. Bottles cont. code	:	ASME Section VIII Div.I

B. OPEARTING CONDITIONS

Fluid handled	:	LPG Vapour
Suction pressure	:	11 to 2 Kg/Sq.cm.g
Discharge pressure	:	12 Kg/Sq.cm.g
Fluid specification	:	LPG conforming to IS 4576
Moisture content	:	Nil
Molecular weight	:	50.5
CP/CV	:	1.12
Area classification	:	class I, Zone I, Group IIA
Tank lorry capacity	:	12 MT average
Tank lorry volume	:	24 Cu.m
No. of tank lorries to be		
Unloaded at a time	:	4 Nos.
Specific gravity of liquid	:	0.52 at 15 Deg.Cent
Intel Temp erature	:	Ambient
Compressibility	:	Zi : 0.7335 Zd : 0.6872
Time required for		
liquid transfer	:	50 minutes
vapour recovery	:	110 minutes
unloading 4 lorry at a time	:	180 minutes

(Liquid transfer + vapour recovery + time for connecting/disconnecting hoses)

C CONSTRUCTION

No of stages	:	Single
Type	:	Reciprocating
Control device	:	Capacity control at 0% , 50% and 100%
Lubrication	:	Forced feed lubricated
Valve type	:	Channel type
Single/double acting	:	Double acting
End connection	:	Suction/discharge
Flange rating	:	ANSI 300 lbs RF
Lubrication for compressor packing	:	Yes
Distance piece purging with nitrogen required	:	Yes
Main oil pump by Hand operated pump set	:	Compressor Shaft
Required	:	Yes
Hydrotest Pressure for Cylinders	:	1.5 X MAWP
Cylinder Jacket cooling	:	:Self contained,forced circulation,closed circuit type cooling system conforming to fig G1, plan D of API 618 4 th edition,1995.

D MATERIAL OF CONSTRUCTION

Cylinder	:	CI IS 210 G.F 250/ Ductile iron ASTM A536
Crank shaft	:	IS 2004 Class IV/ Ductile iron ASTM A536
Piston ring	:	Glass Filled Teflon/ PTFE,glass and moly filled
Valve spring	:	AISI 410/ 17-7PH stainless steel
Piston Rod	:	BS 970 EN 19/ 1045 steel, Nitrotec
Valve seat	:	IS 210 G.FG.200/ 17-7PH stainless steel
Piston	:	CI IS 210 G.FG.250/ Ductile iron ASTM A536
Valve Top	:	IS 210 G.FG.200
Mountings	:	Horizontal
Valve channel & Spring	:	A 151 410/ 17-7PH stainless steel

Cross Head	:	IS 1875 Class III A/ Ductile iron ASTM A536
Volume Bottles	:	Cs IS 2002 Gr2A
Volume Bottles Nozzle flange	:	#300

E. DRIVE UNIT

Reciprocating Compressor shall be driven by induction motor through V belts. The drive motor shall be capable of starting the compressor in unloaded condition with varying suction conditions. The V belt shall be antistatic type and suitable for specified area classification. The belt guard shall be non-spark type. The drive motor shall be rated for minimum 110% of compressor BKW (including all losses) at any of the specified operating conditions or 105% of the power required at relief valve set pressure (including all losses) whichever is greater. The main oil pump shall be driven by compressor shaft and standby lube oil pump shall have electric motor driver suitable for area classification. This drive motor shall be rated for minimum 110% of pump BKW (including all losses) at relief valve set pressure.

F. LUBE OIL SYSTEM:

The Lube Oil system shall be a pressurized system conforming to figure G-5 of API618 4th edition 1995, equipped with main lube oil pump driven by compressor shaft and standby lube oil pump electric motor driven. It shall comprise of duplex lube oil filters, lube oil cooler (if required) and a thermostatically controlled electric oil heater. The Oil cooler (if required) shall be "Shell and Tube" type with removable tube bundle fabricated according to "TEMA C" and sized for not more than 0.5Kg/cm² pressure drop on both shell and tube side.

All lube oil piping from oil consoles to equipment including fittings, valves, instruments and supports shall be included in vendor's scope of supply. Vendor shall engineer the system and furnish detailed P&IDs as well as the piping isometric drawings for the interconnecting piping for purchaser's review & approval during detailed engineering stage. Reservoirs, pumps, coolers, filters and control valves shall be provided on the skid itself.

Filters and coolers shall be fitted with valved vents and drains. The oil spilled by these vents and drains shall be collected properly and routed to a valved drain pot at skid edge. Filters and coolers shall have valved interconnections to permit filling with oil after maintenance. The inlet and outlet valves to oil filters and coolers shall be of three-way type and installed close to filters/coolers. The

operation of both inlet and outlet valves to filters and coolers shall be by a common hand lever to enable smooth changeover.

All piping, fittings, flanges and valve trims etc. shall be of stainless steel for lube oil system. Any tubing required shall be 304/316/321 stainless steel with compression type of fittings of like materials. Compression type of fittings shall be of swage lock type or an approved equivalent.

G. **SOUND**

The maximum sound pressure level of the compressor driver train shall not exceed 88dBA measured at 1M from the equipment surface.

Vibration and position Detectors:

Unless otherwise specified, piston rod drop detectors of Mechanical roller or fuse- metal plug (eutectic) type shall be provided for all machines having non metallic wear bands & piston rings when the compressor rated BKW > 750KW or when differential pressure (between 1st stage suction and final stage discharge) > 70 Kg/cm².

H. **GENERAL**

Following is in vendor's scope:

- i. Torsional analysis of the complete compressor train including the driver and gear unit.
- ii. Selection, sizing, and rating of the power transmission component as also the base plates, sole plates and slide rails.
- iii. Checking the conformity of the motor coupling flange with the compressor coupling flange and supplying to the motor manufacturer in due course of time, the drilling jig for the motor coupling flange, in case of rigid coupling drive.
- iv. Stress analysis of the piping and appurtenances from the intake filter/suction strainer upto the outlet flange of the final compression stage pulsation suppression devices/ separators/ after coolers/air receivers as the case may be.
- v. Furnishing the equipment layout.
- vi. Furnishing the design, type and location of the supports for the piping and appurtenances as defined above under (iv).
- vii. Acoustical evaluation and Mechanical evaluation of the compressor cylinders, pulsation suppression devices, piping and equipment system between the first major vessel upstream of the compressor and the first major vessel downstream of the compressor (if specified).

ALARMS AND SHUTDOWNS (PNEUMATIC)

Control panel	Local Alarm	Remote Shutdown
Low Lube Oil Pressure	Yes	Yes
Low water flow to Comp. jacket	Yes	Yes
High Gas Discharge Temp.	Yes	Yes
Low Gas Suct. PR	Yes	Yes
High comp Discharge PR	Yes	Yes
Low cooling water pressure	Yes	Yes
High cooling water temperature	Yes	Yes

SCOPE OF SUPPLY

The scope of supply shall be, but not limited to the following.

- Drive motor.
- Slide Rail for motor
- V.Belts
- Motor and compressor pulley and guards
- Foundation bolts for motor and compressor
- Lubricator piping
- Suction strainer
- Suction vol. bottle (intel)(common with knock out drum)
- Control panel.
- Cyl.water piping
- Spare for 2 years.
- Instruments.

Safety valves
 Non-return valves.
 Discharge vol. bottle (outlet)
 First oil charge
 Air operated unloaders
 Capacity control system
 Nitrogen purging (Connection Only)
 Regulator device.

A. COMPRESSOR

The compressor shall have, but not limited to the following standard equipment
 Specifically engineered gas ends for LPG service.

Self venting packing case.

Two compartment distance piece as per Fig. 1D.API 618 (86)

Gas cushioned A-Type channel valves.

Outside operated free air suction valve unloaders for 0-50% 100% capacity control.

Completely enclosed frame and running gear.

Force feed frame lubricating system consisting of:-

Shaft driven gear oil pump.

Cartridge type full flow oil filter

Crankcase oil level gauge

Hand operated oil pump.

Full floating aluminium alloy bearings

Metallic 3-segmental, self-adjusting, oil wiper rings.

V-Belt drive consisting of compressor sheave with flywheel effect, motor pulley, anti static V-belt and slide rails for motor.

Full floating self adjusting double acting glass filled teflon cylinder and partition packing rings.

Completely enclosed non sparking V-belt guard.

Foundation bolts for compressor, motor and slide rails.

Foundation plan, instruction Book and parts list.

B. ACCESSORIES:

1 No vertical suction liquid separator as per ASME section VIII Div.1 with manual drain valve.

1 No horizontal discharge volume bottle as per ASME section VIII Div.1 with manual drain valve.

The material of construction of the vessels shall be IS 2002 Gr.2A

1 No safety relief valve full flow type as per API 250

1 No swing check type Non-return valve (loose supply) to be located at the compressor discharge.

1 Nos conical inline strainer for 140 micron mesh size with spool piece.

Gas piping limited to piping between discharge flange of suction scrubber and suction flange of compressor.

Cooling water piping fitting with sight flow glass regulating valves and isolation valve.

C INSTRUMENTATION:

3 Nos Dial pressure gauges SS Bourdon type with two ½ “ NPT isolation valves location at:-

Gas suction

Gas discharge

Lub oil

4 Nos. Temperature gauges bimetallic with ¾ “NPT SS 304 thermo well located at:-

Gas suction

Gas discharge

Cooling water inlet

Cooling water discharge

5.Nos flame proof SPDT pressure switches suitable for gas group IIA/IIB with simultaneous alarm and trip for:-

Low oil pressure

Low gas suction pressure

High gas discharge pressure

Low cooling water pressure

2. Nos flameproof ,SPDT temp. Switch suitable for gas group IIA /IIB with $\frac{3}{4}$ NPT SS 304 thermowell and simultaneous alarm and trip for:-

High gas discharge temperature

High cooling water temperature

1. No reflux type liquid level gauge on suction separator

1 No flapper type SPDT flow switch flameproof suitable for gas group IIA/IIB with simultaneous alarm and trip for low cooling water flow.

2.Nos flameproof solenoid valves for capacity control.

Note:

- (i) The offered instrumentation shall be locally mounted.
- (ii) Only connection o the discharge piece for Nitrogen purging shall be provided by the compressor manufacturer. The design pressure of the distance piece shall be 1 Kg/Sq.cm.g

D. CONTROL PANEL

1 no.10 point FLAME PROOF TYPE control panel suitable for gas group IIA/IIB with solid state Annunciation for the following points.

- 1. Low gas suction pressure
- 2. High gas discharge pressure
- 3. Low oil pressure
- 4. Low cooling water temperature
- 5. High gas discharge temperature
- 6. High cooling water temperature
- 7. Low cooling water flow

Plus 2 spare points

The standard specification of the instruments and the gauge board on enclosed herewith.

Some additional features required to be provided on the panel are as follows:

1. Motor start/stop
2. Acknowledge, test and reset buttons
3. 3-way, rotary, selector switch for 0-50-100% capacity control
4. compressor status lights
5. Time delay relay for unloaded start up
6. Alarms shall just precede shut down
7. Step don transformer
8. Flame proof Hooter
9. Indicating voltmeter

SPECIFICATION OF INSTRUMENTSATION TO BE SUPPLIED WITH COMPRESSOR

SCOPE

This standard sets out the requirements to be observed when supplying plants or equipment which includes Instrumentation.

The following design and construction features shall be adopted:

Power supply 230V 50 cycles.

Clean dry, moisture free instrument air will be supplied at 7.0 Kg./Sq.cm. unless otherwise specified.

All flanges shall be ANSI RF B 16.5 unless otherwise specified.

Instrument shall be with NPT threads.

Where transmission and control signals interface with the control room, cables will be terminated at a junction box adjacent to the package equipment.

All copper tubes shall be PVC covered and well protected.

All process impulses lines and fittings from tapping points to gauge board shall be ¼ "NB CS.

M/s BPCL's approval shall be obtained before the procurement of instruments associated with the package.

All the switches-pressure, temperature and flow shall be suitable for area classification Class-I, Group –IIB. They shall be supplied with explosion proof housing along with CCOE & CMRS certificate and explosion proof cable glands suitable for 2 C x 1.5 sq.mm armoured copper cable. All the switches shall have minimum one change-over contact.

All the temperature and pressure gauges shall have back connection. They shall be flush mounted type and shall be supplied with all mounting accessories.

Details of the requirements for the various forms of measurement are listed below.

FLOW

Flow switches shall be vane type with the NPTF screwed connection.

Flow direction shall be distinctly marked on the body.

TEMPERATURE

Temperature points on vessels and pipes shall be 40 mm NB branches fanged to vessels or pipe standards. Flange protective thermowells having flange rating to suit application shall be used for all temperature elements.

For purely local temperature indication, field temperature indicators with capillary are acceptable, but must be provided with separable flanged thermowells. Thermowell material shall be SS-304. Material for sensing bulb shall be SS-316. Capillary shall be of SS with PVC cover. Temperature switches shall be filled system type with flanges thermowell of SS-304 and sensing bulb of SS-316.

PRESSURES

All pressure-sensing devices even if direct-mounted must be equipped with at least two isolation valves permitting the instrument to be removed for servicing without depressurising the system being measured. Instruments having a maximum scale reading 3 Kg/sq.cm or more shall be equipped with an unobstructed blowout device. Connections to pressure instruments on pipes and vessels shall generally be 1/2 " unless they are for slurry, viscous duties where it will be 2"

SOLENOID VALVES

Solenoid valves shall be explosion proof by CCOE Nagpur & CMRS Dhanbad and suitable for area classification Class I, Zone I, Group II B. They shall be supplied with Ex-proof terminal box with ex-proof cable glands suitable for 2 Cx1.5 Sq.mm armoured copper cable. Coil supply voltage shall be 230 V AC. Solenoid valves shall be suitable for instrument air service (7.0 Kg/sq.cm.g) and shall have NPT covered copper tubes. They shall be provided with manual reset facility.

SCOPE OF INSPECTION:

Correlation/ Review of certificates for:

1. Material test certificate for Piston rod, connection rod, crankshaft and cylinder.
2. Hydrotest for Cylinder.
3. Ultrasonic / Dye Penetrant test certificate for piston rod.
4. No Load Mechanical Run Test of compressor.
5. FLP Motor - Routine test certificate as per IS 2148
6. FLP Instruments :CMRS Certificate
7. Volume Bottles: Hydrotest certificate, Material Compliance Certificate, Radiography and Mill Test Certificate