

PIEDMC GAS DEPARTMENT	SPECIFICATIONS TERM SHEET	SPECIFICATION NO. DM-RME-ROTARY
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**ROTARY TYPE GAS POSITIVE DISPLACEMENT METERS WITH MECHANICAL INSTRUMENT DRIVE
(ID)**

DESCRIPTION:

Rotary Type Gas Positive Displacement Meters with Mechanical Instrument Drive (ID) are required to be installed at Consumer Meter Stations (CMSs) for measurement of gas.

SPECIFICATIONS

A- METERS:

Clause No.	Latest Description
A-1	<u>DESIGN AND DIMENSIONS:</u> Specifications are based on International Standards ANSI B 109.3 (latest Edition) and O.I.M.L. R 137-1&2 (latest Edition) of Gas meters and Company's specific requirement for Rotary type positive displacement gas meters. Wherever the specific requirements differ from ANSI B 109.3 (latest Edition) and O.I.M.L. R137 -1&2 (latest Edition), the specific requirements shall prevail.
A-2	<u>FLOW MEASUREMENT ACCURACY:</u> Between Q min and 0.1 Q max = $\pm 2\%$ Between 0.1 Q max and Q max = $\pm 1\%$
A-3	<u>OPERATING & AMBIENT TEMPERATURE:</u> -20° C to 60° C (-4° F to 140° F)
A-4	<u>INDEX: MECHANICAL COUNTER/ODOMETER:</u> 6-10 digits direct reading built-in counter in cubic meter. - Bidder is required to confirm that the offered design has suitable provision to avoid condensation at ambient condition. Such information is required with reference to the legibility/read of mechanical counter digits rolls. However, in case of vent, such information should be provided in technical literature. - Digit roll of counter and pinions should be strong enough to avoid any slippage/roll over of digit roll during intended life of the meter.
A-5	All internal components should be capable to withstand throughout Operating & Ambient Temperature entire range and should be corrosion resistant.
A-6	<u>METER BODY / IMPELLERS:</u> Should be made of High Pressure Die-Cast Aluminum with hardened machined surfaces.
A-7	<u>CAPACITIES:</u> Should be in cubic meter per Hour (CMH) of Natural Gas.
A-8	<u>DRIVE RATE:</u> The drive rate of Meter should be in cubic meter and compatible for mounting Volume Correctors of MICRO Z-3 & Z-5 RFLO/ El-gas /Mercury / Dresser etc.
A-9	<u>CONNECTION:</u> Flanged connection according to ASME B-16.5, with all dimensions of the threaded hole with imperial units as per standard. Bidder is required to provide corresponding number of bolts with each meter.
A-10	<u>BACK RUN PROTECTION:</u> Preferable to have protection against back run (Reverse flow) of gas by any suitable device that should not be accessed/removed externally without evidence / damaged.
A-11	<u>Installation:</u> Line Mounted Horizontal/Vertical.
A-12	<u>Mechanical Instrument Drive:</u> - i- Mechanical Instrument Drive should be completely housed in a metal case with Bevel Gear Assembly for Clockwise/reversible Rotation to Drive Electronic Volume Corrector. - ii- It should be compatible for mounting Volume Correctors of MICRO Z-3/Z-5/ Mercury / Dresser / El-gas etc. and meter should have provision at the inlet & outlet of the meter to take pressure sensing for the EVCs. - iii- Mechanical instrument drive preferably have Provision to change the direction of driving dock/dog(Clock wise and anti-Clockwise) - iv- The instrument drive and counter assembly must have a rigid attachment with the meter body, preferably by screws. Loose arrangement or any rotatable attachment shall not be acceptable. - v- The counter should not accessible from outside through any filter drain or any other point. - vi- Linkage between measuring chamber (Meter) to the counter assembly should be designed, so that it must not allow any slippage causing loss of gas measurement. (Technical literature having details to elaborate the mechanism of transmission of drive from measuring chamber to counter without slippage). - vii- Magnetic coupling should be immediately after impellers without involvement of intermediate gears or any other mechanism. - viii- Bidder should provide the exploded view of the offered product with labeling of each part, especially about fitment and detailed understanding of the design/attributes of the offered product. - ix- Driving dog/dock should be strong to avoid any deformity.
A-13	<u>SEALING:</u> Sealing screws with drilled Heads should be provided of all points for running sealing wire.
A-14	<u>STRAINER GASKET:</u> One Suitable Strainer shall be supplied with each meter.

A-15	<u>SINGLE CHAMBER;</u> Shall be single chamber with one set of impellers.
A-16	<u>MAGNETIC INFLUENCE;</u> Meter normal operation/working should not be influenced/impact by an external magnet/magnetic field.
A-17	<u>RANGEABILITY;</u> The Range ability of the meters should be defined along with literature mentioning minimum and maximum flow capacities without affecting the accuracy of the meter as mentioned above in Clause A-2.
A-18	<u>METER OIL;</u> The specification of oil required for meters should be provided along with the literature for operation and repair of these meters.
A-19	<u>BEARING;</u> Manufacturer should specifically mention the bearing No. with clearance group and manufacturer name like NTN, FAG, SKF etc.
A-20	<u>THERMOWELL;</u> A thermowell of 316SS or equivalent corrosion resistant material should be supplied with meter having suitable dimensions to cater at least 3.5 inches long (depth) and up to 6 mm dia of temperature sensing bulb of EVC and should be able to be fixed at the outlet/at line pipe of the meters. The hexagonal part for tightening of the thermowell should have a sealing hole for running the sealing wire.
A-21	<u>MARKING;</u> Meter No./Type/Year of manufacturing should be mentioned on the Meter body.
A-22	<u>TIMING GEAR;</u> Preferably timing gears teeth should be helical and strong enough to cater impact load during pressurizing of the meter.
A-22	<u>CERTIFICATION;</u> The bidder should provide the calibration certificates of the same product with valid date of calibration.
A-23	<u>TECHNICAL LITERATURE;</u> Detailed technical literature should be attached with the bid document with reference to understanding the design, details and identification of parts, safety, maintenance /repair, troubleshooting (such as excessive noise/vibration & measurement beyond permissible limits). <u>Bidder should provide Auto CAD /3D drawings of its design.</u>
A-24	<u>DIFFERENTIAL PRESSURE TEST CONDITIONS;</u> Bidder is required to submit test results of differential pressure across the meter in accordance with the requirement of ANSI B109.3, clause 3.7.1 & 3.7.2 that is for starting differential pressure & running differential pressure accordingly.

B- General

B-1	The Bidder should provide list of spares parts complete with part Nos. and item description/nomenclature that will be required for post repairing /maintenance along with respective unit cost of each spare part.
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C-Latest Description / Quantity of Meter with Mechanical Instrument Drive

Sr. No.	Capacity	Description	MAOP	Size	Quantity
1	3000 CFH or Equivalent in Cubic Meter	Meter with Mechanical Instrument Drive having maximum meter capacity (Qmax) 3000 CFH or more	Class 150	2" X 2"	
2	5000 CFH or Equivalent in Cubic Meter	Meter with Mechanical Instrument Drive having maximum meter capacity (Qmax) 5000 CFH or more	Class 150	3" X 3"	
3	7000 CFH or Equivalent in Cubic Meter	Meter with Mechanical Instrument Drive having maximum meter capacity (Qmax) 7000 CFH or more	Class 150	3" X 3"	
4	11000 CFH or Equivalent in Cubic Meter	Meter with Mechanical Instrument Drive having maximum meter capacity (Qmax) 11000 CFH or more	Class 150	4" X 4"	
5	16000 CFH or Equivalent in Cubic Meter	Meter with Mechanical Instrument Drive having maximum meter capacity (Qmax) 16000 CFH or more	Class 150	4" X 4"	
6	23000 CFH or Equivalent in Cubic Meter	Meter with Mechanical Instrument Drive having maximum meter capacity (Qmax) 23000 CFH or more	Class 150	4" X 4"	
7	38000 CFH or Equivalent in Cubic Meter	Meter with Mechanical Instrument Drive having maximum meter capacity (Qmax) 38000 CFH or more	Class 150	6" X 6"	
8	56000 CFH or Equivalent in Cubic Meter	Meter with Mechanical Instrument Drive having maximum meter capacity (Qmax) 56000 CFH or more	Class 150	8" X 8"	
9	102000 CFH or Equivalent in Cubic Meter	Meter with Mechanical Instrument Drive having maximum meter capacity (Qmax) 102000 CFH or more	Class 150	10" X 10"	

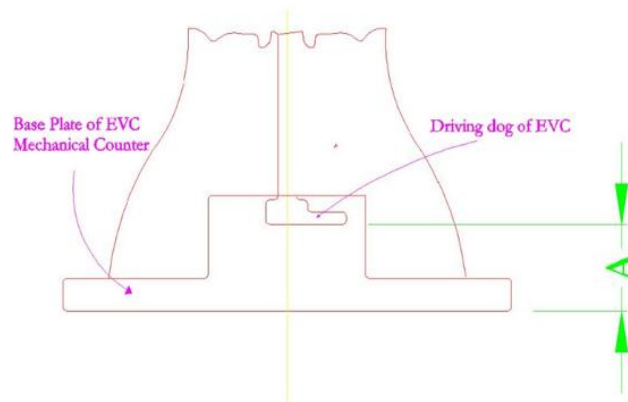
TECHNICAL BID EVALUATION CRITERIA:

Offer of the bidders will be evaluated strictly in accordance with the above stated technical specifications.

ELECTRONIC VOLUME CORRECTORS WITH BUILT IN GPRS MODEM AND SINGLE PRESSURE TRANSDUCER
PIEDMC GAS DEPARTMENT

Clause No.	Specifications
1	<u>DESCRIPTION</u> Electronic Volume Correctors with Built in GPRS Modem for measuring and converting uncorrected volume of natural gas at line conditions to the corrected volume of gas in standard cubic feet units at base conditions and application of necessary super compressibility factor.
2	<u>Correction:</u> 2.1- EVC unit shall be capable of applying following corrections 2.1.1- Pressure (Live or fixed) 2.1.2- Temperature (Live or fixed) 2.1.3- Super compressibility (Live or fixed) 2.2- Capable of calculating and applying super compressibility correction in accordance with following methods: - AGA NX-19 or - AGA-8 At following conditions: • Base Pressure: 14.65psia (shall be configurable) • Base Temperature: 60°F(shall be configurable) • Specific Gravity of Gas between 0.55 to 0.75 (Density of Air = 1) Note: Shall provide super compressibility calculation method as a selectable option 2.3 Equipment shall be approved for legal metrology in accordance with International Measurement Standards such as OIML R140 or Equivalent. 2.3.1 Bidder is required to submit certificate for the above.
3	<u>Environment:</u> 3.1- Intended Location: Open 3.2- Operating temperature Range: 0-158°F 3.3. Ambient temperature range: 0-158°F 3.4. Humidity: 95% non-condensing. 3.5. Shall not be affected by mechanical shock, vibration or electromagnetic disturbance.
4	<u>Materials and Manufacturing:</u> <u>4.1.Essential parts:</u> 4.1.1 <u>Key pad:</u> Must have a key pad that only allows scrolling information on the display. 4.1.2 <u>Display:</u> 4.1.2.1 Shall preferably have alphanumeric LCD/electronic display for reading values. 4.1.2.2 Number of display digits shall be configurable (preferably up to 09 digits with leading zeroes). 4.1.3 <u>Enclosure:</u> 4.1.3.1 EVC enclosure and mechanical counter shall be IP-66 rated i.e., it shall be weather proof. 4.1.3.2 Bidder is required to submit certificate for the above. 4.1.3.3 All the connecting conduits/fittings shall be weather proof. <u>Enclosure Material:</u> 4.1.3.4 Enclosure material should be robust enough to resist crack development due to aging, impact of UV light and effects of weather so as to cope up with the operating conditions of our region. 4.1.4 <u>Safety:</u> Intrinsically safe for measurement of Natural Gas. The Equipment shall conform to Class 1 Division 2 hazardous location or European equivalent (ATEX) or better. 4.1.5.Mechanical Counter:

- 4.1.5.1 Shall have built-in mechanical index (counter) that registers volume by the rotation transmitted by the meter and built in pulsar assembly to convert the mechanical motion to electrical pulses.
- 4.1.5.2 The built in pulsar assembly shall preferably be opto-coupler based.
- 4.1.5.3 The built-in pulsar index assembly shall be compatible with positive displacement rotary meters such as M/s GE (Dresser), Romet, Honeywell etc. and diaphragm meters such as Itron, Rockwell, Honeywell etc. having 0.01, 0.1, 1, 10, 100 & 1000 proving units and option to change the proving unit to any user defined value. The units of volume measurement shall also be interchangeable between ft³ and m³ and shall be visible on the display.
- 4.1.5.4 EVC shall properly register the minimum and maximum flow rates of all types of gas meters installed in SNGPL network in which provision of EVC mounting is available.
- 4.1.5.5 Depth of driving dog with reference to base plate of EVC mechanical counter (i.e., interface of EVC mechanical counter with meter) should be within 9-10mm which is further elaborated in below drawing as annotation 'A' :



- 4.1.5.6 The built-in mechanical index pulsar assembly shall be bi-directional i.e., Index to meter couplings shall be designed such that meter drive rotation can be changed in both directions i.e., forward or reverse (clockwise or counter clockwise).
- 4.1.5.7 EVC shall be protected against any debouncing effect. Moreover, configurable debounce filter shall be provided to eliminate spurious pulses caused by relay contact bounce etc.
- 4.1.5.8 Supplier shall preferably specify the maximum torque of their mechanical index. Amount of force required to drive mechanical counter of EVC shall be so minimal that it would not affect the measuring accuracy of gas meter. To recapitulate above, it is desirable that high torque required to drive EVC shall not cause a shift of meter flow proving results from their OEM results.
- 4.1.5.9 Transfer torque from gas meter to index shall not be affected by mechanical shock and vibrations and electric or magnetic interference. Supplied equipment must qualify the following test conditions:
- a) Mechanical: free fall on each bottom edge from 50 cm to wooden test surface
 - b) Vibration:
 - i. Frequency range: 10-150 Hz
 - ii. Total R.M.S. Level: 7m /s²
 - iii. A.S.D. Level: 1m²/s² for 10-20Hz, 3dB/octave for 20Hz to 50Hz
 - iv. Number of axes: 3
 - c) Electromagnetic susceptibility (radiated):
 - i. Frequency: 80-2000 MHz
 - ii. Field strength: 10V/m, class-A(no effect in instrument operation during and after applying disturbance)
 - iii. Modulation: 80%AM, 1kHz sine wave
 - d) Electromagnetic susceptibility (conducted):
 - i. Frequency: 0.15-80 MHz
 - ii. Field strength: 10V/m, class-A(no effect in instrument operation during and after applying disturbance)
 - iii. Modulation: 80%AM, 1kHz sine wave

e) Electrostatic discharge (ESD) immunity:

- i. Contact discharge: 8kV, 10 discharges, (no affect in instrument operation during and after applying discharges)
- ii. Air discharge: 15kV, 10 discharges (no affect in instrument operation during and after applying discharges)

Bidder is preferably required to submit certificate for the above.

4.1.5.10 First digit roll of mechanical counter shall have opto-reflective silvered zero for the purpose of automated flow proving.

4.1.5.11 Index to meter couplings shall be designed such that it allows the provision to decouple the mechanical counter so that it can be used to translate pulses only when needed.

4.1.5.12 Retaining mechanisms shall be strong enough to carry frictions caused by dust/moisture/rust.

4.1.5.13 Use of adhesive for positional retaining of mechanical parts is not allowed to weed out the possibility of adhesive failure with aging.

4.1.5.14 Driving dog of mechanical counter shall require at least π radians to generate one pulse. Generation of pulse at less than π radians is not acceptable.

4.1.5.15 The mechanical index (counter) shall not be affected by failure of battery or damage to electronic system.

4.1.5.16 Mechanical counter shall preferably have digitizer which shall store pulses and can give back up in case of failure of pulsar board.

4.1.5.17 Tamper Protection: In case of magnetic pulse generating system, the pulsar assembly shall be shielded with some suitable material to safeguard against the influence of electric / magnetic field applied from outside.

4.1.5.18 Relative permeability of shielding material shall preferably be 6000~7000.

4.2 Pressure transducer

4.2.1.1 (a): Gauge pressure sensor (Vented gauge type) alongwith a separate barometric sensor to measure actual atmospheric pressure (Bidder shall preferably submit separate MID parts certificate or equivalent).

(b): Pressure used for calculation of correction factor shall be selectable such that either

$$P_{\text{used for correction}} = P_{\text{gauge}} + P_{\text{barometric sensor}} \quad \text{or}$$

$$P_{\text{used for correction}} = P_{\text{gauge}} + \text{User defined fixed atmospheric pressure.}$$

(c): Capable of operating at altitudes up to 8000 feet above sea level. Sensor shall give zero reading when open to atmosphere regardless of altitude i.e., vented gauge. If gauge calibration is carried out at 2000 ft above sea level then sensor shall measure the same reading at the higher altitude say 8000 ft or above without requiring any calibration.

OR

(d) Provide absolute pressure transducer (Bidder shall preferably submit separate MID parts certificate or equivalent).

{Note either option 1 (a, b & c) or option 2 only (d) may be provided}

4.2.1.2: Range: 0-200 psig

4.2.1.3: Accuracy: $\pm 0.2\%$ of measured value.

4.2.1.4: Long term stability: $\pm 0.1\%$ of full scale for a period of 12 months.

	4.2.1.5: Shall be able to be calibrated in the workshop. EVC must provide multi point calibration. 4.2.1.6 Note: Pressure sensor pipe threads NPT/BSP shall preferably be tapered so as to prevent the leakage of gas from the threads of pressure sensor. Note: Pressure transducer can also be provided externally.
4.5	4.3 Temperature transducer: 4.3.1 RTD sensor 4.3.2 Accuracy: $\pm 0.5^{\circ}\text{C}$ 4.3.3 Dimensions: 4.3.3.1 Diameter: 5.5 to 6.5 mm 4.3.3.2 Length: 3-3.5 inches 4.3.4 Shall be able to be calibrated in the workshop. EVC must provide multi point calibration. 4.4 Power Requirements: 4.4.1 Type: Suitable Lithium batteries 4.4.2 The battery pack shall be intrinsically safe and leak-proof and it shall be fully covered by whatever is the method. Battery must preferably be certified for explosion safety and for leakage safety as well. 4.4.3 Service Life: EVC batteries shall power EVC for atleast five years. 4.4.4 Complete literature for batteries nominal ampere hours, usable ampere hours, useful life and break up of EVC current consumption for performing different functions in graphical form shall be provided. 4.4.5 Cut off voltage of the battery (at which EVC display turns off and calculations are stopped) and corresponding battery percentage at constant drainage rate shall be specified. 4.4.6 EVC shall measure and display battery voltage. 4.4.7 EVC shall have the provision to display low battery alarm on LCD well ahead of the cut off voltage to give enough time margin so that battery can be replaced before EVC display turns off. 4.4.8 The corrector shall not lose any recorded data as well as configuration while replacing batteries. Preferably backup memory chip/non-volatile memory IC shall be present for safe data storage and recovery. 4.4.9 In case of depleted battery all indexes and data logs shall retain their values. 4.4.10 If EVC have the provision to retrieve pulses in case of power failure from primary battery, the retrieved pulses shall be stored/registered in a separate column. 4.4.11 Primary/main battery pack type: Battery pack shall be encapsulated by means of heat shrinking tube or plastic. Cells and circuits must be permanently welded and encapsulated as a whole. Battery holders are not acceptable. Battery pack must be securely mounted on EVC body. 4.4.12 Remaining battery life in ampere hours or percentage based on real battery energy usage must be available. Preferably hardware coulomb counter shall be provided. 4.5 Additional Inputs and Outputs: 4.5.1 4-20-milliamps analog input ports (at least 4-Nos. preferably.) 4.5.2 Digital inputs (at least 4-nos.) 4.5.3 Digital outputs (at least 2-nos.) 4.5.4 4-20-milliamps analog output (1-no. preferably)
5	<u>Performance requirements:</u> 5.1. Accuracy (Overall): Maximum Combined Instrument accuracy (MPE-maximum permissible error) shall be within $\pm 0.5\%$. 5.2. Display Parameters: Shall readily retrieve and display the following parameters or more - Time and Date - Uncorrected volume index - Corrected volume index - Fault/disturbed/error uncorrected volume index - Fault/disturbed/error corrected volume index

- f) Live pressure
- g) Live temperature
- h) Total volume correction factor
- i) Flow rate (corrected and uncorrected).
- j) Engineering units
- k) Battery capacity
- l) Battery voltage

5.3 Data storage capacity:

5.3.1. Capable of storing data as described below

- (a) Hourly log= **minimum 16 months or preferably 02 years or above.**
- (b) Daily logs = 02 years at least
- (c) Monthly Logs = 03 years at least
- (d) Alarm log = 1000 records at least
- (e) Event Log/Status Log = 1000 records at least
- (f) Configuration change log/Audit log/Set up Log = 1000 records at least

5.3.2 Stored data shall not be lost in case of battery failure or EVC internal faults.

5.3.3 Archive and log contents shall be permanently preserved even when EVC battery and back up battery is removed.

5.3.4 If such data is stored in flash memory of the instrument, flash memory wear out protection mechanism shall be present. Supplier shall provide detail of wear out protection mechanism.

5.4 Fault/disturbed/error Volume generation:

5.4.1 There shall be provision for fault/disturbed/error volume generation beyond any user defined/configurable pressure, temperature and flow rate limits.

5.4.2 Generation of fault volume shall not be dependent upon the measuring limits of sensors.

5.4.3 In case of occurrence of fault volume, software/configuration shall have following provisions:

- a) EVC will apply user defined pressure and temperature factor (default value) on uncorrected fault volume to generate corrected fault volume such that:
 - I. Uncorrected reading will continue incrementing while corrected reading is stopped and simultaneously uncorrected fault volume is incrementing and corrected fault volume is incrementing based on user defined pressure and/or temperature value.
 - II. Preferably, uncorrected reading will continue incrementing while corrected reading is also incrementing at user defined pressure and/or temperature values simultaneously uncorrected fault volume and corrected fault volume is incrementing at user defined pressure and/or temperature values (default values).

5.4.4 During the interval of fault/disturbed volume generation, the actual measured values of parameters shall be logged in data and the same shall be displayed on LCD while simultaneously using the default values of parameters for calculating the correction factor.

5.4.5 The indication of correction factor being calculated during fault/disturbed volume instances on EVC LCD shall be coded e.g., as "default" or any other suitable symbol such that the correction factor is not visible on the main display screen so as to avoid confusion by field metering staff.

5.5 Hysteresis:

Application of hysteresis to avoid frequent switching from fault/disturbed condition to normal condition would not affect set limit value of parameter. However, it may be applicable when the parameter normalizes and it shall not be more than $\pm 2\%$ of the limit value.

5.6 If EVC have the provision to retrieve pulses in case of power failure from primary battery, the retrieved pulses shall not add up in fault volume/disturbed volume. The retrieved pulses shall be stored in a separate column as described in sub clause 4.4.10.

5.7 Data logging:

5.7.1 Unit must be capable of logging atleast the following parameters in its daily and hourly data logs:

- a) Time and date of record
- b) Pressure: average, instantaneous maximum and instantaneous minimum.

	c) Temperature: Average instantaneous maximum and instantaneous minimum. d) Uncorrected Volume –index. e) Corrected Volume-index. f) Uncorrected Volume –consumption. g) Corrected Volume-consumption. h) Fault/disturbed/error volume counters-The following counters shall be provided which shall be incrementing in accumulative manner after the occurrence of each fault instant: - i-Fault/disturbed/error volume – uncorrected. - ii-Fault/disturbed/error volume – corrected. i) Uncorrected Reverse volume (Reverse flow in data shall be indicated with a minus “-“symbol.) j) Tamper status. (only in hourly logs) 5.7.2 Must be capable to log atleast the following additional values in its daily and hourly logs: a) Average Correction factor b) Uncorrected flow rate(average, instantaneous maximum and instantaneous minimum) c) In case of fault/disturbance occurred during data logging of any parameter then respective code shall preferably appear alongwith the logged EVC data. d) Battery consumption statistics e) Monthly battery consumption history. 5.7.3 Audit log/Configuration Change log/Set up Log: 5.7.3.1 EVC must have an audit log/configuration change log/Set up log which shall record all the parameter changes that may affect the billing. 5.7.3.2 These audit log entries shall have a date and time stamp. 5.7.3.3 To ensure the integrity of the billing period, the audit log shall not be able to be deleted. 5.7.3.4 It shall have facility to record logs as described in 5.3.1 (f). 5.7.4 Alarm Log: 5.7.4.1 EVC shall preferably have an ‘ALARM LOG’ to monitor the set-point limit violations of the following parameters: 5.7.4.1.1 Low / High Pressure 5.7.4.1.2 Low / High Temperature 5.7.4.1.3 Low / High Flow Rates 5.7.4.1.4 Transducer failure 5.7.4.1.5 Low battery and other system alarms 5.7.4.2 Tamper Alarm: Detection of External Electric/Magnetic Field applied on/around the EVC to disturb its normal operation. The Alarm shall indicate time/date of application of external magnet as well as its removal shall be available in hourly and daily data logs. 5.7.4.3 These Alarm Logs shall be downloadable by using software. 5.7.4.4 Tamper alarm, once appeared, shall be constantly latched at EVC display and shall not disappear without acknowledgement through PC using configuration software. 5.7.4.5 It is the sole responsibility of the bidder to stringently test magnet tamper alarm so as to avoid occurrence of false tamper alarm while EVC is generating pulses to measure uncorrected volume. 5.7.4.6 Hardware Diagnostics: Shall preferably archive hardware diagnostic parameters such as sensor failure, memory, A/D over range and other important hardware system alarms.
	5.8 Configurable parameters: The unit must allow to configure, define and preload at least following parameters: a) Time and Date. b) Engineering Units c) Uncorrected volume index d) Corrected volume index preload e) Uncorrected fault/disturbed volume index f) Corrected fault/disturbed volume index g) Drive rate or meter scale factor preload h) High/Low Alarm limits i) Pressure and temperature values to be used in case of set limits violation.

	j) Base Pressures k) Base Temperature
	5.9 Fixed parameters: Shall have the provision to fix the following parameters: a) Pressure b) Temperature c) Super compressibility factor
	5.10 Feeding of values: 5.10.1 Shall have the provision to feed in the following as a minimum: a) EVC NO b) Name & Address of Consumer c) Consumer No./Consumer I.D up to 14 characters 5.10.2 Parameter shall be downloaded with the EVC data logs which can provide traceability of unit/consumer, this feature is essentially required as the data logs are to be produced before the court of law as evidence of tampering / overloading.
	5.11 Provision for EVC configuration/calibration EVC configuration/calibration shall be through a PC based system/software 5.12 Software: Two types of software shall be provided: 5.12.1 Software for data downloading: Software for data downloading shall allow downloading data from EVC to Laptop Computer and generation of final report to get print out. 5.12.1.1 No option of data configuration and calibration shall be available in this software. 5.12.1.2 Consumer ID/Consumer No. could be entered by using this software. 5.12.1.3 The software shall be able to download data for any specific period of time. It shall prompt for the dates of the period for which the data is required to be downloaded. 5.12.1.4 Data from EVC shall be downloaded/retrieved in non-editable format further convertible to MS Excel, MS Word, PDF etc for analysis/processing. 5.12.2 Software for configuration/calibration: Shall have provision of configuration/calibration of all the parameters as listed in clause 5.8, 5.9 and 5.10. 5.12.2.1 The software shall be able to download data for any specific period of time. It shall prompt for the dates of the period for which the data is required to be downloaded. 5.12.2.2 Data from EVC shall be downloaded/retrieved in non-editable format further convertible to MS Excel, MS Word, PDF etc for analysis/processing. 5.12.2.3 EVC firmware shall be approved as per the Welmec 7.2 covering the requirements of type-P, extension I, L, D, S and preferably T or equivalent. 5.12.2.4 EVC must support real time monitoring data acquisition from Aveva OASYS DNA 7.6 based SCADA system using MODBUS-RTU or DNP-3.0 protocol. Firmware and interface software required for the completion of this activity having all the features committed as per tender specs shall be provided by the bidder. 5.12.2.5 Bidder shall provide latest version software and firmware, release of said software/firmware shall not be older than two years. EVCs provided against current tender shall not be accessible with two year older software/firmware versions of all earlier models of EVCs. In case, manufacturer has already provided EVCs to SNGPL against previous purchase orders. Procedure/mechanism shall be provided to shift all the earlier EVCs which are older than 2 years to this new software. 5.12.2.6 In case of observed fault in design/software/hardware/firmware, the issue will be reported to manufacturer and after joint analysis of issue by manufacturer and SNGPL as well as confirmation and verification of the issue by manufacturer as an anomaly, the solution will be provided by manufacturer free of cost. Generation of printable report: 5.13.1 The EVC software shall be able to generate printable report for any period. 5.13.2 It shall prompt for the dates of the period, for which report is to be generated. 5.13.3 The printable report shall preferably contain the following information:

	a) Time and date b) Pressure: Average, maximum and minimum c) Temperature: Average, maximum and minimum d) Uncorrected Volume e) Corrected Volume f) Correction factor g) Alarms, Pressure, Temperature, and Low Battery etc.
6	<u>Security Features:</u> 6.1. Sealing: 6.1.1. Shall have suitable provision for sealing. 6.1.2. All the screw fasteners, cable glands and nuts used to secure the main enclosure's lid, mechanical counter, transducer cables or any other connections shall have holes drilled in their head/body to allow passing of sealing wire of $\varnothing 2 \pm 0.1$ mm and shall be of material rugged enough to allow repetitive use of sealing wire without breaking during re-use of sealing hole or at consumer site under field conditions. 6.1.3. Any unused ports/connection points shall be properly sealed/ blocked to prevent access to internal parts of EVC. 6.1.4. No exposed electronics are allowed. All internal parts/circuits must be protected / sealed against external access. 6.2. Software protection: 6.2.1 Windows based software for configuration of EVC must be well protected from hacking through implementation of software security measures. Bidder shall certify that said software shall not be available on the internet for downloading / familiarization. 6.2.2 Software for data downloading and software for configuration both shall be customized for SNGPL only so that EVCs supplied to SNGPL shall not be accessible by software provided to customers in other countries of world. 6.2.3 Provided software needs to be installer based 6.3. Data Downloading Port: 6.3.1. The data downloading port must be free from any kind of tampering attempt. 6.3.2. Data downloading port shall remain active and shall not sleep as long as EVC is communicating with PC. 6.3.3. EVC normal operation shall not be disturbed via data downloading port. 6.3.4. Internal parts of EVCs shall be protected and shall not be accessible (visible) through its data ports. 6.4. Configuration/Calibration protection: 6.4.1. On/Off Jumper: a) Shall have an ON/OFF JUMPER inside the body of the EVC to ENABLE and disable configuration / calibration through keyboard and software both. b) When JUMPER is at "ON" position it shall ENABLE configuration / calibration. when at "OFF" position it shall DISABLE configuration / calibration 6.4.2. Data Cable for Configuration/Calibration Two types of cables are required for EVCs. a) Cables for data downloading only: These cables shall have the provision to download data only, with no provision of performing configuration/calibration activities. Each cable shall have a unique ID b) Cables for configuration, calibration and data downloading: These cables shall have the provision to perform all three activities i.e., configuration, calibration as well as data downloading. Each cable shall have a unique ID. Unique ID and Event of optical head whenever attached with EVC shall be logged with date/time stamp for above mentioned both types of cables.

	6.5. Password: 6.5.1. The password protection in addition to “ON/OFF” JUMPER is required. 6.5.2. Password shall be changeable. 6.5.3. The password must be stored in EVC memory. 6.5.4. EVCs shall not allow changes in configuration unless the correct password is entered / communicated to the EVC and JUMPER inside the body of EVC shall be at “ON” position. No changes in configuration can be allowed by EVC unless both password and JUMPER position are fulfilled to avoid any chances of software hacking.
	6.6. Flow sense: 6.6.1 There shall be provision in the software of the EVC to sense the flow direction i.e. volume in reverse flow shall be separated from the volume calculated in forward flow. 6.6.2 There shall be separate indices/counters for measuring uncorrected reverse flow and corrected reverse flow. 6.6.3 In case of reverse flow, uncorrected and corrected readings shall Freeze/stop incrementing. 6.6.4 Upon resumption of forward flow uncorrected reading and corrected readings shall start incrementing immediately. Any compensation from uncorrected reading and corrected reading is not acceptable. In such scenario when uncorrected and corrected reading is frozen/stopped as defined in 6.6.3, there shall be mismatch between meter mechanical counter reading and EVC uncorrected reading to avoid pilferage of gas by means of reverse flow.
	7: Communications 7.1 Description: 7.1.1 Built-in GPRS modem powered by suitable Lithium battery alongwith optional solar PV system with suitable rechargeable battery bank. 7.1.2 The complete communication system shall be powered using solar panel power or solar system battery bank and must not utilize power from the EVC batteries. 7.2 Power: 7.2.1 Separate GPRS modem battery shall be provided independent from EVC battery. 7.2.2 Battery Type: Suitable Lithium battery. 7.2.3 The battery pack shall be intrinsically safe and leakage proof and it shall be fully covered by whatever is the method. Battery must preferably be certified for explosion safety and for leakage safety as well. 7.2.4 Complete literature for batteries nominal ampere hours, usable ampere hours, useful life and break up of GPRS modem current consumption for performing different functions in graphical form shall be provided. 7.2.5 Cut off voltage of the battery and corresponding battery percentage at constant drainage rate shall be specified. 7.2.6 EVC shall measure and display battery voltage (both EVC primary battery and GPRS battery voltage). 7.2.7 EVC shall have the provision to display low battery alarm on LCD well ahead of the cut off voltage to give enough time margin so that battery can be replaced before EVC display turns off. 7.2.8 Battery pack type: Battery pack shall be encapsulated by means of heat shrinking tube or plastic. Cells and circuits must be permanently welded and encapsulated as a whole. Battery holders are not acceptable. Battery pack must be securely mounted on EVC body.

	7.2.9 Remaining battery life in ampere hours or percentage based on real battery energy usage must be available. 7.2.10 GPRS modem shall support operation on both external DC power from solar power system or primary battery. 7.2.11 When external solar power is available, GPRS modem shall not consume power from its primary battery. 7.2.12 In case of solar power failure, modem shall automatically switch to its primary battery. 7.2.13 Battery life must be at least 5 years when GPRS modem runs on primary battery only. 7.2.14 Bidder must present real-time battery consumption measurements during the session of GPRS modem to exchange complete EVC data with the remote-control center when running on primary battery. 7.3 Safety: 7.3.1 GPRS modem must also be included in EVC intrinsic safety certification i.e., it shall conform to Class 1 Division 2 hazardous location or European equivalent (ATEX) or better. 7.3.2 Bidder must provide certificates for above. 7.4 Communication: 7.4.1 Communication system must be able to communicate with the Central Server / Control Room on daily basis through suitable means of communication (both outbound and inbound connections). 7.4.2 These modems shall also be compatible with mobile & wireless communications systems of Pakistan e.g. Mobilink, Ufone, Telenor, Warid, Zong etc. and the communication system must be able to communicate with the Central Server / Control Room on daily basis through suitable means of communication i.e. SMS, GPRS. The detailed mode of communication must be explained along with its viability to ensure daily communication with the Central Control Room. 7.4.3 (a) "Type Approval" & NOC of GPRS Modem from PTA/FAB shall be responsibility of the bidder. (b) If the GPRS Modem is already type approved, the bidder shall provide type approval certificate of their offered model. (c) The supplier shall facilitate SNGPL and fulfill all the pre-requisites on their part regarding registration of all the supplied IMEI devices and extend his support in all respect during the registration process at port of entry with customs and PTA. (d) The supplier shall declare the devices as IMEI based devices at port of entry to the customs along with complete list of these devices with their respective IMEI numbers. (e) The supplier shall provide complete list of these devices on PTA Device Registration System (DIRBS). (f) The supplied devices IMEIs shall be GSMA valid not duplicated/cloned. 7.4.4 Remote communication intervals and time of day must be user defined. 7.4.5 For establishing outbound connections, when specific time of the day is reached, EVC shall activate its remote communications interface (GPRS), establish connection(s) with one or more remote server(s) located at control room, transmit collected information, exchange data, receive commands, and execute any tasks defined by the system administrator, end the session and disconnect. It shall then go back to hibernation mode and shall wait for the next specified interval and repeats this operation. 7.4.6 GPRS modem shall also operate as a listening server (inbound) i.e., the server Software shall be able to automatically communicate with EVCs by means of communication system at fixed interval. When specific time of the day is reached EVC shall activate its remote communications interface (GPRS), establish connection(s) with one or more remote
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server(s) located at control room, transmit collected information, exchange data, receive commands, execute any tasks defined by the system administrator s and its remote communications interface (GPRS). At the same time, it shall remain active and accept incoming connections from control center for as long as the length of interval defined by user.

- 7.4.7 The communication shall preferably be by means of a permanent socket connection to ensure 100% data communication without any fail.
- 7.4.8 GPRS modem shall preferably support multiple concurrent outbound and multiple concurrent inbound connections.
- 7.4.9 For establishing multiple outbound connections, more than one remote server IP and port may be defined such that GPRS modem shall be able to try another remote server if one server is found inaccessible.
- 7.4.10 Simultaneous connections shall not cause EVC local communication ports to slow down, or stop, or any kind of performance degradation.
- 7.4.11 When external power is present, GPRS modem shall immediately establish continuous outbound connections and also accept continuous inbound connections, and shall maintain their stability and health.
- 7.4.12 GPRS Modem must have configurable auto reconnect feature as soon as external battery power is restored.
- 7.4.13 When external power becomes unavailable, GPRS modem shall switch from continuous mode to intermittent connection mode. It shall automatically abort existing connections and wait for user-configurable time of day. When this time of day is reached, the GPRS modem shall wake up and establish/allow the connections as described in clause No 7.4.5 and 7.4.6.
- 7.4.14 Transition between the two power modes shall be automatic and seamless.
- 7.4.15 GPRS modem and EVC shall support either Modbus RTU or Modbus TCP/IP or preferably both.
- 7.4.16 Shall be able to communicate with SCADA system and control center software simultaneously.
- 7.4.17 For easy adaptation of EVCs to existing SCADA software, Modbus addressing must be configurable and shall not require programming.
- 7.4.18 Consumer ID & EVC Serial No. length as defined in section 5.11 along with UOM must be readable on SCADA with appropriate data format e.g. BCD, float etc.
- 7.4.19 SCADA polling frequency: Minimum SCADA polling frequency shall be Every 1 hour. Maximum SCADA polling frequency shall be Every 10 minutes.
- 7.4.20 Minimum duration of each communication interval: 20 seconds.
- 7.4.21 RTC synchronization: EVC clocks shall preferably be able to be regularly synchronized by the control center software and/or by the SCADA software. Furthermore, protection mechanism shall also be provided preferably to protect against erroneous clock updates generated as a result of wrong configurations or human faults.
- 7.4.22 Modem must be capable of communicating daily, hourly and monthly logs, alarms, event logs etc., as described in Clause 5.7.
- 7.4.23 Shall provide communication statistics such as Signal Level (RSSI), TCP sockets information, number of failed TCP connections, registering GSM network and preferably Bit Error Rate.
- 7.4.24 Shall provide diagnostic information for identifying a communication problem between SCADA/Control Center and remote EVC.
- 7.4.25 Shall provide the feature of SMS reporting.
- 7.4.26 Number of authorized SMS recipients must be user defined.

	7.4.27 Messages must be user configurable as alarm messages or daily/hourly reports. 7.4.28 User must be able to select/specify the alarms that trigger SMS reporting. 7.5 Communication software: 7.5.1 The Server Software shall preferably be able to integrate with existing software system i.e., AVE2 of M/s. Geovapspol. s.r.o. Czech Republic and DMASFLO of M/s. RMFTEK Inc, Turkey for smooth operations. If it cannot be integrated with existing software system then mechanism shall exist to migrate existing EVCs to the new software system. 7.5.2 Any additional software such as operating system, database or third-party software along with software licenses shall also be provided by the supplier. 7.5.3 In parallel to client-based software, the supplier shall also provide a WEB-based interface for overall management of EVCs. 7.5.4 The communication software (software for the server side to manage the remote stations) shall have a provision to accommodate data of at least 2000 EVC sites. 7.5.5 Preferably the availability of RESTful API (REST API) to retrieve/post data from the EVCs or from the EVCs server shall be provided. 7.5.6 Supplier shall provide server end software as mentioned in Clause 7.5.1 and 7.5.2 (01-No software for production environment and 01-No software for testing purpose). 7.6 Materials and manufacturing: 7.6.1 Solar PV system: 7.6.2 Shall be properly sized to support device load such that in case of solar power unavailability, the system shall be able to provide backup for a period of 21 days 7.6.3 Solar panel 7.6.3.1 Type: Mono-Crystalline. 7.6.4 Battery Pack: 7.6.4.1 Type: Suitable Li-Ion battery. 7.6.4.2 Charging temperature: 32°F to 113°F. 7.6.4.3 Discharge temperature: 32°F to 140°F 7.6.4.4 Battery Life: 05 Years minimum. 7.6.5 Solar Charger: 7.6.5.1 Type: MPPT solar charge controller. 7.6.5.2 Low voltage protection point shall be specified by the manufacturer. 7.6.5.3 Shall preferably have an electronic display for showing charge voltage, charge current, battery voltage, battery capacity, output current etc. 7.6.6 Power and safety barrier cabinet/combiner box: 7.6.6.1 Shall be IP 67 rated. 7.6.6.2 Bidder is required to submit certificate for the above. 7.6.6.3 All the connecting conduits/fittings shall be weather proof. 7.6.6.4 Cabinet shall include a suitable certified safety barrier between solar power system output and EVC/GPRS modem external DC input (Bidder is required to submit safety certificate of the safety barrier). 7.6.6.5 Antenna: High gain external antenna. 7.6.6.6 Mounting assembly/Kit for solar PV system: 7.6.6.6.1 Complete mounting assembly / kit (e.g. pipe-stand bracket etc.) alongwith suitable connecting cables shall be provided. 7.6.6.6.2 Mounting kit type: Pole mount type with adjustable tilt angle. 7.6.6.6.3 Material: Corrosion resistant material. 7.6.6.6.4 Mounting Pole dimensions: 7.6.6.6.4.1 Mounting post nominal dia. max : 2" 7.6.6.6.4.2 Mounting post outside diameter: 60mm
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	7.7 Operation and maintenance manuals to be provided. 7.8 Online workshop or support for communication to Central Control Room with the aspect of checking performance of 30 Nos. of EVCs with modems which are installed at site (for training of SNGPL Executive / Staff). Print out of 5 days data logs are essential.
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8:ACCESSORIES WITH QUANTITIES

8.1. Description

- 8.1.1. Windows Based Software for Downloading EVC data: 01 No.
- 8.1.2. Windows Based Software for configuration of EVC: 01 No.
- 8.1.2.1 Software's against 8.1.1 & 8.1.2 shall be provided through electronic link.
- 8.1.3 Hardware keys: 01 Nos.
- 8.1.3.1 Bidder shall provide latest model hardware keys such that software provided against subject tender shall not be accessible by hardware keys provided for all earlier model of EVCs.
- 8.1.3.2 Provided hardware keys shall have a unique ID.
- 8.1.3.3 Unique ID of hardware key shall be logged with date/time stamp against all events recorded in event log.
- 8.2 The bidder shall quote prices of following spares parts required for trouble free and smooth operation of the system
- 8.2.1 Suitable leads/cables for configuration, calibration and data downloading of EVC as per 6.4.2 shall be provided as given below:
Total = 05 Nos. (Break up of which is as under)
 - I. Cables for data downloading only = 03 Nos.
 - II. Cables for configuration/calibration and data downloading: 02 Nos.
- 8.2.2 LCD: 10 Nos.
- 8.2.3 Pressure Transducer: 10 Nos.
- 8.2.4 Temperature transducers: 10 Nos.
- 8.2.5 Battery Packs: 10 Nos.
(Battery packs shall be completely assembled and ready to be used without requiring resistance welding, soldering and wrapping in heat shrinkable sleeve. The battery pack shall have male/female connector to connect them with the circuit board of EVC).
- Mechanical counter: 05 Nos.
- 8.2.6 Push button for EVC: 10 Nos.
- 8.2.7 Modem Antenna: 05
- 8.2.8 Modem module (Pluggable/Replaceable): 05

9: General

- 9.1 *Supplier will be required to conduct a workshop at manufacturers production facility to explain operation, configuration, calibration, data retrieval and troubleshooting / maintenance of the system to PIEDMC's technical team*
- 9.2 *After installation in the field, if PIEDMC observed failure of design/software/hardware, it will be reported to manufacturer and it will be promptly scrutinized/ analyzed by the manufacturer jointly with PIEDMC and necessary trouble shooting/support will be provided by manufacturer in order to use EVCs confidentially.*
- 9.3 *The Bidder may quote separately the frequently replaceable parts along with Part Nos. and budgetary prices required for trouble shooting/maintenance purposes.*
- 9.4 *The bidder shall separately quote the instruments required for calibration of EVCs.*
- 9.5 *The bidder shall quote list of essential spares, required for trouble free and smooth operation of the system for a period of at least two years.*

- 9.6 It is mandatory for every bidder to submit 01 Nos. samples of EVC along with necessary accessories i.e., solar panel, solar power box, mounting kit, connecting cables etc and software to test its functionality. *The necessary accessories items, i.e., solar panel, solar power box, mounting kit, connecting cables etc. along with sample submission shall be exempted in case the similar accessories have already been provided with EVCs supplied by the bidder against previous purchase orders but not older than 2 years of same design, features and model as quoted against current tender.*
- 9.7 Supplier shall provide comprehensive technical literature so as to evaluate compliance with or deviation from above technical specifications. Technical literature shall be inclusive of vendor documentation i.e. technical literature of their vendors.
- 9.8 Bidder is required to provide technical support, if possible, to highlight the possibilities of tampering the equipment.

TECHNICAL BID EVALUATION CRITERIA:

Offer of the bidders will be evaluated strictly in accordance with the above stated technical specifications. Bidder shall quote necessarily required quality assurance equipment to gauge the health of used EVCs.

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	Title	LOW DIFFERENTIAL HIGH CAPACITY GAS REGULATORS	date	23/08/2024
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DESCRIPTION:

Required for installation at Regulatory Station and Consumer Meter Stations

1. GENERAL REQUIREMENTS:

Low Differential Pressure Regulator shall conform to the following requirements.

- 1.1 **Type of Gas:** Natural Gas Specific Gravity 0.58 – 0.7
- 1.2 **Regulator Casing:** All portions of the regulator case and all parts of the regulator assembly which are exposed to the flow of gas shall not be affected by any constituents of natural gas and any additives normally used in the operation such as odorant.
- 1.3 **Temperature:** For all the specific requirements the regulator shall operate over a temperature range of -20° F to 140°F.
- 1.4 **Operating Pressure:** Maximum Allowable Operating Pressure = 175 psig and should comply with minimum differential pressure of 05-07 psig and capable to operate at minimum inlet pressure of 10 Psig.
- 1.5 Construction of the regulator should be rugged to cater for the dust particles and condensate in the gas.
- 1.6 Manifold velocity on regulator outlet flange (or equivalent for threaded connection) shall be less than 150 m/sec to increase long term reliability, prevent vibration and reduce excessive noise emission.

2. SPECIFIC REQUIREMENTS:

2.1 BODY:

- 2.1.1 Regulator Body material shall be Carbon Steel / Ductile Iron. The direction of flow shall be clearly and permanently marked on the body.
- 2.1.2 Screws and bolts and nuts shall be accessible and conform to latest edition of ANSI B-1.1.

2.2 DIAPHRAGM CASING ASSEMBLY:

- 2.2.1 Inside of the casing shall be free of fins, cores and burrs.
- 2.2.2 Diaphragm casing and spring cage shall be suitable for the flow/pressure parameters.

2.3 DIAPHRAGM & SEAL:

- 2.3.1 Diaphragm shall be made of Buna “N” reinforced with Nylon fabric or the Dacron fabric reinforced Nitrile or equivalent.
- 2.3.2 The regulator shall have built-in provision of special seal to prevent from unauthorized change in gas pressure.

2.4 VALVE MECHANISM:

- 2.4.1 Valve Linkages shall be corrosion resistant or corrosion protected materials and shall operate freely without binding and the durably constructed to prevent accidental disengagement of moving parts.
- 2.4.2 Valve seat shall be soft and made of moulded Buna “N” or Polyurethane or Nitrile or equivalent for complete bubble tight shut-off at all pressure differentials at no flow. The valve disc shall be

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so mounted that it will align itself for complete contact with the seating surface of the valve orifice.

2.5 **Operation:**

2.5.1 Pilot operated. Suitable for monitoring i.e. as set of two regulators, one on working and other on monitoring. Necessary accessories for the throat blocking etc should be provided with each regulator.

2.5.2 Fail to Open.

2.6 **SPRING:**

2.6.1 Spring screw shall maintain its adjusted setting without creeping.

2.6.2 Spring screw shall be protected against tampering by means of a suitable screwed seat cap or cover and that can be removed without damage.

2.6.3 Cover shall be weatherproof construction with threads protected against corrosion.

2.7 **SET POINT:**

2.7.1 Regulators to be set at following pressures. Additional springs to enhance range are also acceptable.

Size	2"	3"	4"	6"
Outlet Pressure (psig)	5	5	10	15
Inlet Pressure (psig)	15	15	25	40
Outlet Pressure Spring Range (psig)	3 – 30	3 – 30	3 – 50	5 – 60

2.7.2 Regulator shall not pulsate or chatter when installed in any position as recommended by the manufacturer.

2.7.3 Regulator shall have sealing provision to take care of pressure tampering.

2.8 **INLINE MAINTENANCE:**

2.8.1 Regulator should be such that in-line maintenance can be done without removing regulator.

2.9 **EXTERIOR FINISH:**

2.9.1 Regulator shall have a rust proof exterior finish.

2.10 Following Standard information shall be permanently marked on the diaphragm casing assembly or on attached tag.

a. Model No.	b. Manufacturer Name	c. Spring Range	d. Pressure Rating
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2.11 **FLOW COEFFICIENT (CG):**

Minimum Flow Coefficient (Cg) of regulators as mentioned below.

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Size	2"	3"	4"	6"
Cg	2,000	4,000	6,300	11,000

2.12 **ACCURACY:**

- 2.12.1 $\pm 5\%$ AC or better. Variation in outlet pressure (set point) between Minimum and Maximum Flow including DROOP should not exceed $\pm 5\%$

2.13 **PRINTED LITERATURE:**

- 2.13.1 20 Copies of Brochure including principle of Operation installation and Maintenance procedures of Regulator should be provided with consignment.

2.15 **QUALITY CERTIFICATION:**

- 2.15.1 Bid should accompany valid ISO-900:2015 certificate of the manufacturer.

	PIEDMC Specifications		Rev #	00
	Title	SPECIFICATIONS OF LEAK CLAMPS	date	01.01.2022
			Page	1

Clamps with full seal for pinholes circumferential leak, breaks or cracks for 4” dia. to 16” dia. steel linepipe having following specification.

1. Accommodate wide range of outerdia variation.
2. Light weight.
3. Band shall be made from Corrosion resistant stainless steel (type 304) Min. 0.80mm Thickness for 4” and above sizes and 0.50-0.80 mm for upto 2” sizes.
4. High strength stainless steel bolts having spin-fit threads, treated with an anti-galling agent, got fast installation.
5. Lugs shall be epoxy coated and made from S.G iron ASTM A-536.
6. Stainless steel gas bridges cemented to the gasket where the band sections join, to provide the 360 clamping pressure.
7. Tapered end gridded gasket, made of specially compounded rubber, has a gridded pattern for positive sealing and tapered ends to make installation quick and easy.
8. Shelf life of sealing gasket should be three years or more.
9. Suitable at Operating pressure of 100 PSIG for 3/4” to 6” leak clamp.
10. Suitable at operating pressure of 150 PSIG for leak clamp (8” to 16”)
11. Suitable for Temperature Range of 25°F to 125°F
12. Dimensions:

Nominal Pipe Size Inch	Outside diameter of pipe Inch	Length of Clamp Inch
4”	4.50	12”
6”	6.625	12”
8”	8.625	12”
10”	10.750	12”
12”	12.750	12”
16”	16.00	15”

The suppliers, must submit atleast one samples alongwith their bid to evaluate field performance and site suitability. (The manufacturers / supplier already supplied the same type of leak clamps to the company may not require to submit the samples).

	Technical Specifications		Rev #	01
	Title	PRESSURE GAUGES (GLYCERIN FILLED)	Date	23-08-2024
			Page	01

TYPE

Pressure Gauges with 4” dial size, Glycerin filled and ½” NPT Male Connection (bottom)

RANGE

0-100 Psig/0-60 Psig

APPLICATION

- Measuring and indication of pipeline pressure for natural Gas.
- Manufactured and calibrated in accordance with ANSI Specification EN837-1 or B40-1, Grade 2A.
- Corrosion resistant, easy reading, white scale with black division and numerals; 270° arc.
- Pressure Gauges should read with an accuracy of $\pm 1\%$ of full scale or better.
- Bourden tube material to be 316 stainless steel with stainless steel socket.
- Threads ½” in accordance with ANSI B 1.20.1

TECHNICAL LITERATURE/CERTIFICATIONS

- The manufacturer unit must be accredited with ISO 9001: 2015 certificate for the current period must accompany bids.
- Local bidder should inform website address of the quoted pressure gauge manufacturer.
- Original technical literature/brochure of the manufacturing unit revealing the detailed features of the offered items must accompany bids, failing which the bids shall not be entertained.

	Technical Specifications		Doc. #	PIE-GAS-CIPV-1	PIEDMC Procurement SPECIFICATIONS
	Title	1" to 6" Plug Valves (ANSI Class-125)	Rev. #	01	
			Date	23-08-2024	
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1. **SCOPE:**

This specification covers the supply of Standard Cast Iron Taper Lubricated Plug Valve with ANSI Class 125 ratings generally conforming to BS 5158. These valves are required for aboveground installation on consumer meter stations and pressure regulating stations on Natural Gas Distribution Network. The size and specific valve requirement is given in the 'Schedule of Requirement' of the tender documents.

2. **MATERIAL SPECIFICATIONS:**

Valve components shall be of the following materials:

2.1 **Body Cover, Gland & End Flanges.**

Grey/Cast Iron conforming to ASTM A 126 Class-B or ASTM A 278

2.2 **Plugs:**

Grey/Cast Iron conforming to ASTM A 126 Class-B or ASTM A 278

Plug surface shall be impregnate with anti-friction PTFE to ensure consistent operating torque by reducing friction between plug surface and valve body.

2.4 **Cover and Bolting:**

(i) Cover ----- ASTM A 126 Class-B or ASTM A 278

(ii) Bolts ----- ASTM A193 Grade B7

(iii) Nuts-----ASTM A194 Grade 2H

(iv) Gasket ----- Graphite or PTFE or Metallic

2.6 **Wrenches:**

Cast, Forged Carbon Steel or of Malleable Iron.

3. **Valve Operators:**

ANSI Rating	Size	Operators
Class 125	Upto 6 "	Wrench operated preferably 'D' Drive Wrench

4. **Plug Valve Pattern/Configuration**

4.1 Valves shall be of the following pattern and configuration:

ANSI Rating	Size	Valve Pattern	Valve Configuration/T ype	Port Area
Class 125	Upto 6 "	Short	Standard	Min. 60%

4.2 **Valve Dimensions:**

The face to face or end to end dimensions of valves shall be in accordance with BS 5158.

5. **GENERAL REQUIREMENTS:**

5.1 All valves shall have seat sealant injection provision.

5.2 Valves offered must be in regular line of manufacture and shall be substantiated with regular catalogues/brochure and or drawings. Customized or prototype design shall not be acceptable.

5.3 All valves shall be provided with operating wrench.

	Technical Specifications		Doc. #	PIE-GAS-CIPV-1	PIEDMC Procurement SPECIFICATIONS
	Title	1" to 6" Plug Valves (ANSI Class-125)	Rev. #	01	
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6. **OPERATING/TESTING REQUIREMENTS:**

- 6.1 All valves scheduled under this specification will be installed on above ground installations like consumer meter stations and pressure regulating stations etc. on a pipeline transporting Natural Gas In Distribution Network. Valves shall be capable of being operated by hand against a full working pressure differential without the use of extension levers or bars.
- 6.2 Valves shall be suitable for the following maximum working pressure:
ANSI Class 125 - 175 PSIG
- 6.3 Valves shall be subjected to hydrostatic seat and shell test in accordance with BS-5158. Test pressure and Duration for shell test and seat test is specified hereunder. Pressure shall not fall below the specified test pressure during the test period. Valves shall show no leakage either for Shell or Seat test during the test period.

Test Pressure Class	Valve Size	Shell Test		Seat Test	
		(Bar)	(Minutes)	(Bar)	(Minutes)
ANSI Cl.125	Upto 6"	20.7	2 min. or as per relevant Standard	15.2	2 min. or as per relevant Standard

- 6.4 Manufacturer shall furnish a report of pressure tests performed. Such reports shall include the test pressures and test durations.
- 6.5 **The bidders shall furnish alongwith their bids details of testing to be carried out i.e. Shell/Seat Test, duration of testing. Furthermore, the bidders shall specify the maximum operating/working pressure (MOP) for the offered valves.**

7. **VALVE END CONNECTIONS:**

END FLANGES: End Flanges shall be furnished with Flat Face as specified in "Schedule of Requirements" of the Tender Enquiry. Dimensions and tolerances, including drilling templates, flange facing spot facing and back facing shall conform to ANSI B16.5.

8. **PACKING, PAINTING AND PROTECTION:**

Packing shall be sufficiently robust to withstand rough handling during ocean shipment and up-country journey. All items shall have their respective identification letters or numbers painted on body and these shall be suitably packed to provide ease of handling and storage and maximum protection during transport and storage periods.

9. **MANUFACTURER'S GUARANTEE:**

The manufacturer shall guarantee the material, design and operation of the valves covered by the purchase order, to the extent that if any defects chargeable to faulty workmanship, design, or material are found in the valves within a period of two years after the valves are installed in regular service, the manufacturer shall furnish replacement for any defective part or parts thereof free of charge. If the valve is found defective at the time it is placed in service, the manufacturer shall replace it.

	Technical Specifications		Doc. #	PIE-GAS-CIPV-1	PIEDMC Procurement SPECIFICATIONS
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10. **COMPLIANCE:**

The manufacturer will be responsible for complying with all the provision of this specification a certificate to this effect shall be furnished with the bid. Any variation from the specifications shall be specifically indicated by the bidder in their offer.

11. **TRACEABILITY/IDENTIFICATION:**

Each valve shall be suitably and permanently marked with valve identification/traceability information/data which shall include the following:

- i. ANSI Class
- ii. Valve Size/Type
- iii. Manufacturer's name and year of manufacturing and any specific identification No. as per their Catalogue.
- iv. Purchase Order/Contract No.

12 **ACCREDITATIONS/CERTIFICATIONS:**

The manufacturer must have API-6D accreditation for manufacturing of Plug Valves to assess capability of the manufacturer. The manufacturing experience will be considered from the date of API accreditation. Supplier/manufactures are required to only submit end user list for Class-125 Plug Valves to access post qualification of their offered product as per tender clause 3.2 b & c. A current/valid certificate to this effect obtained not less than five years from the date of bid opening must be submitted along with the bid.

The manufacturer must have relevant ISO 9001:2015 accreditation and Current /valid certificate to this effect must be submitted along with the bid.

	Technical Specifications		Doc. #	PIE-GAS-NV-1	PIEDMC Procurement Specifications
	Title	NEEDLE VALVES	Rev. #	01	
			Date	23.08.2024	
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Needle Valve, Screwed End, Series 150 / 600, Integral seat. Hand wheel non-reversible on the Spindle and arranged for clockwise closing.

MATERIAL: Steel conforming to ASTM A105.

THREADS: Female x Female, NPT Threads conforming to ASME 1.20.1.

Packing: Graphite or Eq.

PACKING:

Packing shall be sufficiently robust to with stand rough handling during ocean shipment and up-country journey.

PROTECTION:

Valves shall be shipped with the Ends protected over the entire contact surface with suitable protectors securely attached to the valves.

MARKING / TRACEABILITY / IDENTIFICATION:

Each valve shall be suitably and permanently marked with valve identification / traceability information / data which shall include the following:

- i. Class
- ii. Valve Size / Type
- iii. Manufacturer's name OR manufacturer's specific identification mark as per their Catalogue.

Manufacturing unit shall be accredited with ISO 9001 or ISO 9002; a copy of valid/current certificate to substantiate the claim must accompany bids. Original technical literature / brochure of the manufacturer revealing the detailed features of the offered item must be submitted along with bids.

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	Technical Specifications		Rev #	01
	Title	STUD BOLT	Date	23-08-2024
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Description

Alloy Steel Stud Bolts complete with 2 Nuts & 2 Washers

Material:

Stud Bolts: ASTM A193/B-7

Nuts: ASTM A-194/2-H

Washers: B.S. 3410

Threads: UN Series ASME / ANSI B 1.1

Packing: Stud Bolt shall be packed in assembled form complete with two nuts and washers. Stud Bolts per carton shall be up to maximum 100 pieces max. depending of Size of Stud Bolt. Packing carton shall be two ply or better to withstand packing of Stud Bolts.

Samples: Two Samples of complete set are required against each item from the supplier who have not already supplied the same brand of the manufacturer to the company.

	Technical Specification		Doc. #	PIE-GAS-PFIJ-1	PIEDMC Procurement SPECIFICATIONS
	Title	PRE-FABRICATED INSULATING JOINTS CLASS 150	Rev. #	01	
			Date	23.08.2024	
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Cathodic Protection Prefabricated Insulating Joint Assembly Class-150 complete for installation in high pressure natural gas transmission lines of following specifications.

1. Design Codes : ASME VIII Div-II App.2
2. Electrical Resistance in Dry Air : 6.0M Ohm
3. Breakdown Voltage in Dry Air : 3500 Volts at 50Hz.
4. Operating Temperature Range : 0° - 80°C
5. Beveled Welding Ends : According to API Spec 5L

Class 150

- 6 Maximum Working Pressure : 285 Psig
7. Test Pressure : 428 Psig
8. **Material:**

- | | | |
|---------------------|---|---|
| Steel Parts | : | API 5L Gr B (As per Schedule of Requirement). |
| Gasket | : | Aerylonthril/ butadiene elastomer according to ASTM D2000. |
| Insulating Material | : | Laminated epoxy resin reinforced with Glass Fabric according to ASTM D 709 type 4 Group G11. |
| Filling | : | Epoxy cold curing resin. Nick of bell shall be sealed by silicone rubber to avoid penetration of dust and moisture. |
| Internal | : | Epoxy powder resin DFT 200 micron |
| External | : | Epoxy powder resin DFT 200 micron |

9. Following Third Party Test Certificates shall be provided (As per NACE SP0286-02) at the time of delivery.

- (i) Pressure Test Certificate
- (ii) Electrical Insulation Test Certificate

The manufacturing unit must be accredited with ISO 9001 or ISO 9002, a certificate for the current period must accompany bids. Original technical literature/brochure of the manufacturer giving details of the offered Pre-Fabricated Insulating Joints must be furnished along with the bid.

	Technical Specifications		Doc. #	PIE-GAS-WNF-1	PIEDMC Procurement Specification
	Title	WELD NECK FLANGES CL. 150/300 600	Rev. #	01	
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Weld Neck Flanges of ANSI Pressure 150/300/600 shall be as per schedule of requirement. Working pressures and temperature ratings of the Flanges shall be in accordance with table 3 of MSS SP-44, 1996 edition. Design and manufacturing of Flanges for sizes NPS ½” – 10” shall be in accordance with ANSI B 16.5-1988 edition and for sizes larger than NPS 10” shall be in accordance with MSS SP-44 specifications 1996 edition. Thicknesses provided in the schedule of requirement are thicknesses of the pipes to which the required Flanges are to be welded. Therefore these thicknesses are at the weld ends of the Flanges.

MATERIAL: The steel used for Flanges manufacturing shall be killed steel.
Weld Neck Flanges shall be of forged steel of any of following material grade as under:
ANSI Rating Class 150/300/600: ASTM A 105, ASTM A350
LF2, ASTM A694
(Details of material and pipe run specifications as per Table A: Material and Pipe run Specifications)

CHEMICAL

ANALYSIS REPORT: Flanges manufacturer shall furnish chemical analysis report in conformance to para 3.1.3.1 MSS SP-44 1996 edition.

CARBON EQUIVALENT: The steel used shall have a maximum Carbon Equivalent (CE) not exceeding the limits mentioned hereunder:

$$CE (IIW) = 0.48\%$$

Weld Neck Flanges are required to be welded to steel Line pipes API Spec 5L of Grades as specified in schedule of requirement and the manufacturer shall issue a weld conformance certificate stating that the Flange(s) shall be field weld able to the matching steel line pipe grades using cellulosic electrodes.

MECHANICAL

PROPERTIES: The steel used for Flange manufacturing shall have suitable mechanical properties in accordance with table 1 of MSS SP-44 1996 edition. Tensile properties shall be determined in accordance with ASTM A-370.

HEAT TREATMENT: Heat Treatment of all the Flanges shall be made in accordance with Section 4 of MSS SP-44, 1996 edition.

TOLERANCES: Tolerances for sizes NPS 10 and smaller shall be as specified in ASME/ANSI B16.5. Tolerances of flanges from NPS 12 and larger shall be as under:

FLANGE THICKNESS:

Sizes NPS 18 to 12 :+0.12 -0 inches

Sizes NPS 20 and larger :+0.19 -0 inches

FLANGE OUT DIAMETER (DIMENSION 'H' IN TABLE 6,7,8,9 &10 OF MSS, SP-44):

Sizes NPS 24 and smaller :+0.16 -0.03 inches

Sizes NPS 26 and larger :+0.21 -0.06 inches

FLANGE INSIDE DIAMETER (DIMENSION 'B' IN TABLE 6,7,8,9 &10 OF MSS, SP-44):

Sizes NPS 18 to 12 :+0.06 -0.06 inches

Sizes NPS 20 and larger :+0.12 -0.06 inches

	Technical Specifications		Doc. #	PIE-GAS-WNF-1	PIEDMC Procurement Specification
	Title	WELD NECK FLANGES CL. 150/300 600	Rev. #	01	
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IMPERFECTIONS:	Permissible imperfections in Flange facing finish shall be in accordance with table 11 of MSS SP-44, 1996 edition.
RING DESIGN:	Flange's Ring design shall be according to para 5.2 of MSS SP-44, 1996 edition.
DRILLING TEMPLATES:	Drilling templates of Flanges shall be in accordance with para 5.1.3 (class 600 flanges), 5.1.2 (class 300 flanges) and 5.1.1 (class 150 flanges) of MSS SP-44, 1996 edition.
HUB DESIGN:	Hub design of the Flanges shall be in conformance to para 5.3.3 and 5.3.4 of MSS SP-44, 1996 edition.
WELDING ENDS:	The Welding ends of the Flanges shall be in accordance with figure 2 of MSS SP-44, 1996 edition.
MARKING:	Flanges shall be marked as required in MSS SP-25 with addition of manufacturer's name or trade mark.
CODE/TESTING:	Code limitations and testing of the Flanges shall be in accordance with para 8 of ASME/ANSI B16.5 1988 edition and para 8 of MSS SP-44, 1996 edition.
REPORTS:	The manufacturer shall furnish Certified Material Test Report, duly signed/ stamped by third party inspectors deputed by PIEDMC, for following: • Actual results of chemical analysis. • Mechanical properties. • Heat treatment. • Nondestructive examination. • Manufacturer shall certify that the Flanges provided are capable to operate at maximum pressure of 1480 PSIG (for Flanges of ANSI rating class 600), 740 PSIG (for Flanges of ANSI rating class 300) and 285 PSIG (for Flanges of ANSI rating class 150).
TEST PRESSURE:	Flanges covered under these specifications shall be designed to withstand a hydrostatic test pressure of 2220 PSIG (class 600 flanges), 1110 PSIG (class 300 flanges) and 428 PSIG (class 150 flanges).

NACE COMPLIANCE

If a specific item in SOR is required to comply to NACE, it should conform to the requirements of NACE MR0175/ISO15156. The material listed in the materials section of the specification should follow the recommendations of Section A.2.1.2 through A.2.1.9 of the Annex A of NACE MR0175/ISO15156-2.

The manufacturer should furnish a certificate of conformance to NACE and the flanges shall be marked showing compliance to the standard.

	Technical Specifications		Doc. #	PIE-GAS-WNF-1	PIEDMC Procurement Specification
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The manufacturer should also ensure weld ability of the offered materials to the corresponding pipe materials mentioned in Table A of these specifications.

Manufacturing unit shall be accredited with ISO 9001 or 9002; a copy of valid/current certificate to substantiate the claim must accompany bids. Authority letter and original technical literature/ brochure of the manufacturer revealing the detailed features of the quoted material must be submitted along with bids. Sales reference list of the manufacturer outside manufacturer's own country to at least five renowned gas/oil companies within last five years, with addresses and contact numbers and description of the sold material, must be submitted with the bid.

	Technical Specifications		Doc. #	PIE-GAS-WNF-1	PIEDMC Procurement Specification
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TABLE A: MATERIAL AND PIPE RUN SPECIFICATIONS

Flange Size	Matching Pipe Run Specifications			Flange Material		
	CL – 150	CL – 300	CL – 600	CL – 150	CL – 300	CL – 600
1"	0.133" WT Gr – B	0.179" WT Gr – B	0.179" WT Gr – B	ASTM A 105/ ASTM A 350 LF2		
2"	0.154" WT Gr – B	0.218" WT Gr – B	0.218" WT Gr – B			
3"	0.216" WT Gr – B	0.300" WT Gr – B	0.300" WT Gr – B			
4"	0.237" WT Gr – B	0.337" WT Gr – B	0.337" WT Gr – B			
6"	0.188" WT Gr – B	0.432" WT Gr – B	0.432" WT Gr – B			
8"	0.219" WT Gr – B	0.277" WT Gr X – 46	0.277" WT Gr X – 46	ASTM A 105/ ASTM A 350 LF2	ASTM A 694 F 46	
10"	0.219" WT Gr – B	0.307" WT Gr X – 46	0.307" WT Gr X – 46		ASTM A 694 F 52	
12"	0.250" WT Gr – B	0.344" WT Gr X – 46	0.344" WT Gr X – 46			
16"	0.250" WT Gr – B	0.438" WT Gr X – 46	0.438" WT Gr X – 46			
18"		0.438" WT Gr X – 52	0.438" WT Gr X – 52		ASTM A 694 F 70	
20"		0.500" WT Gr X – 52	0.500" WT Gr X – 52			
24"			0.438" WT Gr X – 70			ASTM A 694 F 70
30"			0.562" WT Gr X – 70			
36"			0.688" WT Gr X – 70			
42"			0.750" WT Gr X – 70			
48"			0.875" WT Gr X – 70			

	Technical SPECIFICATIONS		Doc. #	PIE-GAS-WFT-1	PIEDMC Procurement SPECIFICATIONS
	Title	BUTT-WELD PIPE FITTINGS EQUAL TEES/REDUCING TEES/CONCENTRIC REDUCERS/WELD CAPS/LONG RADIUS ELBOWS	Rev. #	01	
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All welding Fittings supplied under these specifications shall be seamless Forged Carbon Steel Butt-Weld Pipe Fittings generally conforming to material grades WPB to WPHY70 as specified in the schedule of requirement. Thicknesses provided in the schedule of requirement are thicknesses of the pipes to which the required Fittings are to be welded. Therefore, these thicknesses are at the bevel ends of the Fittings and in no way should be treated as the thickness of fitting main body. ***Weld Tees shall be designed for stress concentration/ compensation; for instance, crotch thickness shall be greater or equal to 1.5 times the nominal thickness.***

Welding Fittings shall be in accordance with MSS SP-75 1998 edition, except as modified by the Company's special conditions set out herein. Dimensional requirements for Fittings of NPS 16 to NPS 48 shall be in accordance with MSS SP-75 and NPS 14 and smaller shall be according to the standard ASME B16.9 or ANSI B16.11, whichever is applicable.

Fittings up to and including 20" OD shall be seamless. Larger diameter Fittings with one longitudinal seam in the pipe run without any circumferential weld, square or angular, may be acceptable. All welds shall be made according to welding procedures qualified under the provisions of section IX of the ASME Boiler and Pressure Vessel Code. Submerged arc welding shall be done with at least one pass from the inside and weld seam shall be 100% radiographed, ultrasonically examined.

Weld metal used in the construction of Fittings shall be suitable to meet the notch toughness and tensile strength requirements of section 8 and 11 when heat treated in accordance with section 9 of MSS SP-75, 1998 edition. Welding after heat treatment is strictly prohibited.

MATERIAL: The steel used shall be fully killed steel, made by using recognized melting practices to provide intended heat treat response and notch toughness properties. Material of the fittings shall be forged steel as listed below:

SCREWED FITTINGS : ASTM A 105

WELDING FITTINGS (GRADE B-WPHY42) : ASTM A 234

WELDING FITTINGS (WPHY46 – WPHY70) :

CHEMICAL MATERIAL CONFORMING TO TABLE-1 MSS SP-75

ANALYSIS REPORT: Fittings manufacturer shall furnish two certified chemical analysis reports from each heat lot of material at two different locations in conformance to table 1 of MSS SP-75 1998 edition.

CARBON EQUIVALENT: The steel used shall have homogeneous structure and Carbon should be evenly distributed though out the steel. The steel shall

have a maximum Carbon Equivalent (CE), at any location, not exceeding the limits mentioned hereunder:

$$CE (IIW) = 0.45\%$$

Carbon equivalent lesser than 0.45% shall be preferred. The manufacturer shall issue a weld conformance certificate stating that the Fitting(s) shall be field weldable to the matching steel linepipe grades using cellulosic/low hydrogen electrodes.

TENSILE PROPERTIES: Tensile properties of the Fittings shall meet the requirements as specified in table 2 of MSS SP-75, 1998 edition, ASME B16.9

	Technical SPECIFICATIONS		Doc. #	PIE-GAS-WFT-1	PIEDMC Procurement SPECIFICATIONS
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	or ANSI B16.11. Tensile properties shall be determined in accordance with ASTM A-370.
PRESSURE RATINGS:	Maximum allowable working pressure ratings for the Pipe Fittings shall be calculated as per Section 2 of MSS SP-75, 1998 edition.
HEAT TREATMENT:	Heat Treatment of all the Fittings shall be made in accordance with section 9 of MSS SP-75, 1998 edition. Welding after heat treatment is strictly prohibited.
TOLERANCES:	Tolerances for sizes up to NPS 14 shall be in accordance ASME B16.9 or ANSI B16.11 and for sizes from NPS 16 to NPS 48 shall be in accordance with section 13 and table 3 of MSS SP-75, 1998 edition, except thickness tolerance stated hereunder: <u>THICKNESS TOLERANCE:</u> Sizes NPS 48 and smaller : +0.10 -0 inches
WELDING ENDS:	Welding ends of the Fittings shall be in accordance with figure 1 of MSS SP-75, 1998 edition.
NDT/ INSPECTION:	Nondestructive examination and inspection of all the Fittings manufactured under these specifications shall be carried out in accordance with section 15 and 16 of MSS SP-75, 1998 edition. Each Fitting shall be ultrasonically examined; personnel and procedures shall be qualified in accordance with ASME Section V, Article 5.
DESTRUCTIVE TESTING:	One test, to determine yield strength, tensile strength and percent elongation, shall be made from each heat lot of material (of the same starting wall thickness) from which the Fittings are made. If the test specimen from any heat fails to conform to the requirements for the particular grade ordered, then retests on two additional pieces from the same heat lot shall be made, each of which shall conform to the requirements specified in table1. If one or both of the retests fail to conform to the requirements, entire lot/heat shall be rejected. For Fittings of grades WPHY 60-70, notch toughness test shall be performed on each heat lot of Fittings in accordance with the requirements of section 11.
DESIGN PROOF TESTING:	Design proof tests shall be made in accordance with Section 4 of MSS SP-75, 1998 edition. All fittings under these specifications shall be designed to withstand a field hydrostatic test pressure, after installation at a pressure level equivalent to that required to develop a hoop stress equal to the specified minimum: yield strength of pipe of equivalent grade and wall thickness based on Barlow's Formula, without failure, leakage of impairment of serviceability, Barlow's formula is defined as: $P = \frac{2ST}{D}$ Where P is the Pressure in pounds per square inch S is the specified minimum yield strength of the pipe in pound spare square inch T is the nominal wall thickness of the pipe in inches D is the outside diameter of the pipe.

	Technical SPECIFICATIONS		Doc. #	PIE-GAS-WFT-1	PIEDMC Procurement SPECIFICATIONS
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REPORTS:

The manufacturer shall furnish Certified Material Test Report, duly signed/ stamped by third party inspectors deputed by PIEDMC, for following:

- Actual results of chemical analysis, Section 7 of MSS SP-75, 1998 edition.
- Mechanical properties, Section 8 of MSS SP-75, 1998 edition.
- Notch toughness properties, Section 11 of MSS SP-75, 1998 edition.
- Heat treatment, Section 9 of MSS SP-75, 1998 edition.
- Nondestructive examination, Section 15 of MSS SP-75, 1998 edition.
- Manufacturer shall certify the hydrostatic test pressure, the Fittings provided are capable to withstand.

IMPERFECTIONS:

Welding Fittings shall be free of injurious defects and shall have workmanlike finish. **Repairs of injurious defects shall not be allowed.** Injurious defects are those having a depth in excess of 6.5% of specified nominal wall thickness. Repairs, chipping or grinding of welds, where applicable, shall be done to avoid gouge, groove or reduction in original metal thickness by more than 6.5%. Manufacturer shall furnish a certificate for the Fittings to be free of defects.

MARKING:

Fittings shall be clearly marked on outside diameter with the following information with low stress die stamps:

- Manufacturer name or trade mark.
- Size and nominal wall thickness of Fitting at bevel ends.
- Grade of the Fitting according to table 2 of MSS SP-75, 1998 edition.
- Heat code identity.
- Design pressure.

PROTECTION:

Fitting shall be shipped with the Ends protected over the entire contact surfaces with suitable protectors securely attached to the welding ends.

PACKING:

Packing shall be sufficiently robust to withstand rough handling during ocean shipment and up-country journey.

Manufacturing unit shall be accredited with ISO 9001 or 9002; a copy of valid/current certificate to substantiate the claim must accompany bids. Authority letter and original technical literature/ brochure of the manufacturer revealing the detailed features of the quoted material must be submitted along with technical proposal. Sales reference list of the manufacturing unit outside manufacturer's own country to at least five renowned gas/oil companies shall also be submitted alongwith technical proposal.