

PETRONAS TECHNICAL STANDARDS

DESIGN AND ENGINEERING PRACTICE

MANUAL

INSTRUMENT AIR SUPPLY

PTS 31.37.00.11

FEBRUARY 2011



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PTS Circular 2011 - 2



PTS No:	31.37.00.11
PTS Title:	Instrument Air Supply
Base PTS Version:	Release 13

This revision of PTS **31.37.00.11 - Instrument Air Supply (February 2011)** has been updated to incorporate PETRONAS Lessons Learnt, Best Practice and new information issued by relevant industry code and standards.

The previous version of this PTS **31.37.00.11 (December 2007)** will be removed from PTS binder / e-repository from herein onwards

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Revision History

Date	Version	Description of Updates	Author

Summary of Changes

Section	Changes
1.1 GENERAL	Followings were deleted (highlighted in bold): This PTS specifies requirements and gives recommendations for the design and engineering of instrument air supply systems to provide a reliable supply of instrument air of the required quality. This PTS also specifies requirements and gives recommendations for pneumatic signal lines, including their connection to the instrument air supply lines/header; in so doing, it incorporates the relevant content of PTS 32.37.51.11., which is now withdrawn. This PTS is a revision of an earlier PTS of the same number dated July 1985, see (1.5).
1.3.2 Abbreviations	Followings were added: P&ID: Piping and Instrumentation Diagram
2.1 ARRANGEMENT	Followings were deleted (highlighted in bold): The instrument air supply system shall provide the required quantity of: - instrument air of the quality specified in (2.2); - industrial air for approved cases, as specified in (2.3); - air for safety equipment (2.4). The system shall comprise an air supply plant as specified in Sections 3 to 7, and a main air supply piping system as specified in Section 8. Specific guidelines for applications are provided in Section 9.
2.2 INSTRUMENT AIR QUALITY	Followings were added (highlighted in bold) and deleted (strikethrough and highlighted in bold): The instrument air shall be free from oil and other liquids, toxic, corrosive, flammable and obnoxious gases or vapours. The quantity of solids shall be less than 0.1 g/m³ and the diameter of the particles shall not be more than 3 µm. In-line fine filters shall be installed to meet these requirements. ~~NOTE: Older plants may still operate successfully with 30 µm filters~~

Section	Changes
	To prevent condensation in the supply piping and instruments, the dew point of the air at operating pressure shall be at least -40°C or 10 °C below the lowest expected ambient temperature for the air system at any location, whichever is more stringent. An on-line dew point analyser shall be installed to continuously monitor the instrument air dewpoint. ~~In any climate, this normally results in standard dew point specification of -40°C at atmospheric condition, whichever is more stringent. In mild and cold climates this normally results in standard dew point specification of -40 °C at atmospheric conditions, whereas in tropical climates 0 °C would suffice. Integrated IA systems with nitrogen/oxygen supply may have dew points specified at -65 °C depending on the possible combined air dryer service. Unless otherwise specified, the maximum instrument air supply temperature shall be 40 °C; the Principal may specify a higher temperature but, for proper operation of the instruments, this should not be higher than 70 °C.~~
2.3 INSTRUMENT AIR SUPPLY FOR INDUSTRIAL CONSUMERS	The whole section contents were deleted.
2.3 AIR SUPPLY FOR SAFETY EQUIPMENT	Followings were added (highlighted in bold) and deleted (strikethrough and highlighted in bold): Safety equipment such as breathing air masks should be supplied from separate air bottles rather than from an IA system so as to avoid any contamination ~~or conflict of use, particularly in large distributed systems~~ and HSE issues. Use of IA system should be avoided as much as possible, unless under emergency conditions.
2.4 INSTRUMENT AIR QUANTITY	Followings were added: It is recommended that the instrument air quantity/consumption be reviewed once every 5 years.
2.6 SECURE INSTRUMENT AIR SYSTEM	Followings were deleted (strikethrough): ~~Where required for plant operation, the air supply system shall be segregated into an instrument air (IA) system and a priority instrument air (PIA) system. This segregation shall primarily be based on the importance of continued operation of a particular plant section or selected instruments.~~ ~~In this context, utility supply plants such as electric power plants, boilers with related deaerators and boiler feed water systems, fuel and cooling water systems, shall normally be connected to the PIA system. Certain processing units (e.g. less critical or less profitable units) may be segregated from the IA system, depending on the probability of calamities or the financial consequences of an unexpected shutdown.~~

Section	Changes
	~~The above segregation shall be achieved by installing one or more isolating control valves in the instrument air supply piping, see Appendix 7 and Appendix 8. Each isolating control valve shall consist of a pneumatically-operated control valve with a local pneumatic pressure indicating controller operating as a back-pressure controller, i.e. throttling the valve in the event of low air pressure in the upstream piping. The control valve shall be provided with a position switch, which will initiate an alarm on the main panel/console when the valve starts to close. Each isolating control valve shall have block valves and a by-pass valve.~~ ~~In the event of low air pressure, industrial air supplies shall be isolated automatically or manually from the air supply system before instrument air is segregated.~~ ~~The option of installing manually-operated isolating valves in the supply piping for segregating certain sections, e.g. to allow the commissioning of individual sections before plant construction is complete, should also be considered.~~ Consumers connected to the IA system which must stay in operation after a total air supply failure, e.g. valves for the depressurizing of equipment, shall be supplied from a 'secured instrument air' (SIA) system which is a buffer vessel connected to the distribution piping via a non-return device in accordance with PTS 32.45.10.10, see Appendix 11. Details for functional design, such as back-up time and consumption rates, shall be supplied by instrument engineering.
3. AIR SUPPLY PLANT	Followings were replaced (highlighted in bold): The humidity shall be measured with a water content moisture analyser having a local indication and a high-humidity alarm on the main panel/console.
4.2 COMPRESSOR SPECIFICATIONS	Followings were added (highlighted in bold): The compressors shall supply oil-free air and shall be complete with intercoolers, aftercoolers and condensate draining facilities, etc. Intercoolers and aftercoolers shall be preferably located outside for easy maintenance and under suitable weather protection. If medium is cooling water, material shall be suitable to prevent stress corrosion cracking (SCC). In principle, air cooled coolers with radiator fluid should be preferable over external cooling medium.
4.3 COMPRESSOR CONTROLS	Followings were replaced and added (highlighted in bold): Automatic starting of the stand-by compressor(s) shall be as fast as possible. Initiators Low Pressure transmitter shall be provided on the piping downstream of the buffer vessel, on the instrument air header, to start the stand-by compressor(s) (see drawing in Appendix 1). Stopping of a

Section	Changes
	compressor shall be indicated by an alarm on the main panel/console. Facilities to select duty and stand-by compressor(s) shall be provided. The electric motor(s) shall have local start/stop controls and be protected against repetitive starting. Electrical controls supplied as an integral part of the compressor shall be interlocked with the start/stop controls and shall be located in a weatherproof housing on, or close to, the compressor. The control system shall be highly reliable and segregated for the compressors.
4.4 COMPRESSOR INLET AND DISCHARGE	Followings were added (highlighted in bold): The compressor inlet piping shall be provided with dust filter(s) and a facility to indicate differential pressure across the filters locally readable at ground level and in the DCS. The inlet piping and filter casing shall be of stainless steel (see PTS 39.01.10.11).
6.1 GENERAL	Followings were added and deleted (highlighted in bold): At least two identical (2 × 100 %) subsystems of air drying equipment shall normally be installed to ensure a high system availability and reliability. Each set typically comprises: Two dryers (one operating, one in regeneration/stand by mode) Inlet and outlet filters also for regeneration air One regeneration air blower One regeneration air heater One depressurization silencer The automatic sequence control of the dryer subsystem, i.e. adsorption / regeneration (see 6.3) / standby control is part of vendor package (see 6.4) and preferably a standalone unit powered from secured electrical plant supply. The change-over between the two air drying equipment 100 % subsystems shall be selectable to be either manual or automatic. The two systems should be switched over on a two-weekly rotation basis or as per recommended operation and maintenance practice. The air drier shall reduce the dew point of the air, under operating pressure at a maximum oversaturation of 5 %, to meet requirements as specified in section 2.2
6.3 REGENERATION	Followings were added (highlighted in bold): Where regeneration at atmospheric pressure is applied, the vessel shall be depressurized slowly to prevent blowing out and/or fragmenting of the desiccant through two stage venting valve equipped with silencer to

Section	Changes
	reduce exhaust noise. After the desiccant has been regenerated, the vessel shall be pressurized slowly before switch-over.
6.4 SWITCHING	Followings were added (highlighted in bold): Automatic switching (nomally provided by Vendor as part of the package in a PLC program) shall be integrated with the automatic controls for the regeneration cycle and shall be on a adjustable fixed time schedule.
6.5 FILTERS	Followings were added (highlighted in bold): All filters shall be in duplicate and serviceable while the unit is running, have isolating valves and DP measurements with alarm.
8.1 GENERAL	Followings were added: All tubing requirements shall be as per PTS 32.37.20.10.
8.2 LAYOUT	Followings were added (highlighted in bold): Arrangement should be such that the shortest path between source and instrument is taken. Dead lags (possible of water/dust accumulation) should be avoided. All instruments shall be accessible for operation & maintenance. The piping shall be arranged so that a continuous supply of instrument air is ensured, even under abnormal situations such as shutdown of plant sections, or when changes to piping have to be made, i.e. individual isolation not just by equipment but by plant units/sections as well.
8.4 PIPING DETAILS	Followings were added (highlighted in bold): Branch connections from piping in process sections shall be a minimum of DN 15 with steel ball valves with PTFE seats & packing.
9.1 CONTROL ROOM	The whole section contents were deleted.
9.1 FIELD COMPONENTS	Followings were added (highlighted in bold) and deleted (strikethrough and highlighted in bold): For general applications, the instrument air supply lines from the header up to the isolating valve(s) close to the air consumer(s) shall consist of 16 mm OD carbon steel tubing with carbon steel compression fittings ~~of type 304~~

Section	Changes
	~~or~~ 316 stainless steel tubing with stainless steel compression fittings. Instrument air supply lines from the carbon steel valve(s) to the air consumer(s) and the pneumatic signal lines shall be as per PTS 32.37.20.10 consist of 6 mm OD PVC covered copper tubing and brass compression fittings or 304/316 stainless steel tubing with stainless steel compression fittings (refer PTS 30.01.10.11). All components, tubing and compression fittings shall be suitable for use at 10 bar (ga) and 38 °C. Note: The application of tubing and compression fittings shall comply with the following: - the compression fittings shall be of the make, type and composition as specified for the project by the Principal and of which all parts of the fitting are made by one Manufacturer. Mixing of fitting from different manufacturer shall not be allowed. - the tubing shall be in accordance with the specification supplied by the Principal - the fittings and tubing shall be installed by skilled personnel, strictly in accordance with the Manufacturer's instructions - the instrument air lines shall be pressure tested after installation. Each instrument and final control element requiring an air supply shall be provided with an individual air filter ~~reducer~~ regulator. Note: The types of air filter reducers shall be kept to an absolute minimum. ~~The outlet of each air filter reducer regulator shall be provided with a brass quick connector and a PVC dust cap attached by chain to the connector.~~ The maximum number of consumers that may be connected to the same 1/2 inch NPT take-off point shall be calculated with account being taken of the minimum allowable inlet pressure of each air filter reducer and the total length of supply tubing, on the assumption that all connected instruments are consuming air at the maximum rate. All components such as air filter reducers, lock-up devices and solenoid valves shall be bolted to a stainless steel mounting plate which is fixed to a support with stainless steel bolts. ~~Copper tubing is considered to be self supporting up to lengths of 0.5 m; for longer lengths, the tubing shall be supported over the full length and fixed to the support at approximately 1 m intervals with cable ties.~~
10. REFERENCES	PTS 32.37.20.10 (Instrument signal lines) was added.
APPENDIX 10 INSTRUMENT AIR SUPPLY IN	Appendix 10 was deleted from the document.

Section	Changes
CONTROL CENTRE – TYPICAL ARRANGEMENT IN BASEMENT	

PREFACE

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