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## About This Standard

This specification details the design principles, equipment performance, installation methods and testing procedures for compressed air reticulation systems for railway signalling use. The reticulation system will be used to drive track turnouts and train stops, both actuated by pneumatic cylinders. High flow rotary air motors are not used.

The specification is to be read in conjunction with the Particular Specification which will define the location and extent of the work.

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## 1.1. General Requirements and Scope

This specification details the design principles, equipment performance, installation methods and testing procedures for compressed air reticulation systems for railway signalling use. The reticulation system will be used to drive track turnouts and train stops, both actuated by pneumatic cylinders. High flow rotary air motors are not used.

The specification is to be read in conjunction with the Particular Specification which will define the location and extent of the work.

Installation of an air reticulation system, as defined by this specification, includes all necessary work from (and in some cases including) the point(s) of supply to the connection to the pneumatic signalling equipment.

It is to be assumed that air to be supplied via any connection to an existing air reticulation system is not dried.

## 1.2. Installation Drawing

The drawings listed herein form part of this Specification and outline preferred methods of installation.

| Drawing Number | Subject  |
|----------------|--|
| 092000 / 01-1  | Control Manifold                               |
| 092000 / 01-2  | Connection to Single Train Stop                |
| 092000 / 02    | Branch or Sub Main Connection to Main          |
| 092000 / 03    | Mains, Supports and Anchor Points Drainage,    |
| 092000 / 04    | Buried Steel Mains                             |
| 092000 / 05    | Drainage of Cross Ties & Underground PVC Mains |
| 092000 / 06    | Insulating Flange                              |
| 092000 / 07    | Steel Air Main Brackets                        |
| (092000 / 08)  | <i>Not Used</i>                                |
| 092000 / 09    | Drainage - Surface Mains                       |
| 092000 / 10    | Typical Twin Compressor Installation           |



### 1.3. Referenced Documents and Standards

The listed Australian Standards and other Specifications are referenced in and are to be read in conjunction with this Specification.

| Standard / Specification Number | Title                                   |
|---------------------------------|---|
| AS 1210                         | Unfired Pressure Vessels                |
| AS 1074                         | Steel Tubes for Ordinary Service        |
| AS 1449                         | Wrought Alloy Steels – Stainless        |
| AS 1477 Part 1                  | PVC (UPVC) Pipes                        |
| AS 1477 Part 5                  | Solvent Welded for UPVC Pipes           |
| AS 1518                         | Extruded Polyethylene Coating for Pipes |
| AS 1650                         | Hot Dip Galvanised Coatings             |
| AS 2129                         | Flanges for Pipes                       |
| AS 2528                         | Hoses and Hose Assemblies for Air       |
| AS 1650                         | Hot Dip Galvanising                     |
| ARTC Spec SCP 21                | Cable Route Construction                |

### 1.4. Definitions

**"Ladder system"** shall mean two main air lines, generally one each side of the railway tracks, cross connected at regular intervals and able to be fed from any direction.

**"Cross tie"** shall mean the cross connection between two main air lines. It may or may not be across railway lines.

**"Manifold"** shall mean the pipe and valve assembly where connection from the air main to pneumatic signalling equipment is made.

**ARTC's Signalling Representative (or "Supervisor")**

A Company, Person or Authority authorised to make determinations on behalf of Rail Access Corporation

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## 2. INFORMATION PROVIDED TO THE CONTRACTOR

The shall be provided with:-

- a) The available information on the existing air reticulation system and pneumatic signalling equipment in the work area to which the new work is to be connected and/or plans showing the proposed location of the new reticulation system and new pneumatic signalling equipment.
- b) The available information on the location of existing cable routes and any existing air reticulation system which is to be replaced by the new work.

It shall be the Contractor's responsibility to confirm the accuracy of information on the plans supplied and determine the location of any other services including the location of existing cable routes.

## 3. INFORMATION REQUIRED FROM THE CONTRACTOR

### 3.1. System Design

Prior to the ordering of any materials or the commencement of any site works, the following plans and documentation shall be submitted for approval.

- a) A detailed site survey plan which shows (and dimensions) the location and size of all pipework, compressors, reservoirs, cross ties, manifolds, valves, expansion joints, anchor points, pits, under-line and under-road crossings.

This plan shall, on completion of the work, be brought up to "As built" status and forwarded to the Superintendent's office within 30 days of completion of the work.

- b) Complete operating and construction data for all compressors, valves, filters, dryers, lubricators, regulators, expansion joints, etc which may be required to ensure reliable operation of the system and compliance with this specification. It shall be necessary to obtain type approval for these components except where this is already held
- c) Where the new system is fed (or partially fed) from an existing system, the flow rate required from the existing system and the extent to which the new system can back feed the old.

### 3.2. Components

Components which are specially manufactured for the system, eg. manifolds, shall be fully detailed on drawings as shall compressor installation layouts.

Proprietary items such as compressors, valves etc shall be fully identified by Manufacturers (and Agents where applicable) name, type number and catalogue number. In addition, the materials used in manufacture and the Australian (or other) Standard to which the item is manufactured are to be stated.

Where a product has not previously been supplied to ARTC, the Superintendent may call for samples before permission for use is given.

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## 4. WARRANTY

### 4.1. Warranty

The whole of the reticulation system installed to this specification including all components therein, whether proprietary items or not, shall be warranted by the Contractor to be free of defect for a period of twelve months after the commissioning of the work.

### 4.2. Minimum Standards of Workmanship

All pipework and hose shall be blown through with air supplied at 800 kpa and/or shall be washed with clean pressurised water and thoroughly dried prior to installation to remove any grit or metallic particles

All threaded joints shall be sealed with "Loctite Master Pipe Sealant" or approved equivalent or taped with Teflon thread sealing tape.

Open ends of any installed pipework, hose or valve shall be capped until connected to other pipework or hose to prevent contaminant entry.

## 5. SYSTEM DESIGN

### 5.1. Layout

Unless otherwise required by the Particular Specification ladder systems shall be used with cross ties at intervals most suited to isolate the system into sections.

So far as possible, sectioning of the system shall be such that:-

- a) In the event of a leak in either air main or any cross tie, the leak can be isolated and all equipment restored to service or, in the worst case, only the equipment connected to one manifold will be affected.
- b) In the event of a leak within a manifold, the leak can be isolated and only the equipment connected to that manifold will be affected.

Manifolds shall be placed adjacent to the equipment to which they are to be connected. Only where it is physically impossible to place a manifold will permission be given to locate a manifold more than 75 metres from the equipment it supplies

Where the Particular Specification requires only a single main system, this shall be fed from both ends at least and shall be sectioned such that (a) and (b) above apply. The positioning of manifolds shall be as required for ladder systems

### 5.2. Capacity

Each main in a ladder system shall be capable of carrying the full system load.

The size of main required shall be as stated in the Particular Specification but shall be within the range 20 - 40 mm diameter where train stops only are operated and within the range 40 - 75 mm diameter where points or points and train stops are being operated.

(Note that the main size specified will usually greatly exceed that required for normal leak free system operation. The size is based on capacity to tolerate leakage from hose or valve failure and to tolerate abnormal loading during recovery from failure)

Pressure in any part of the system shall not fall below 420 kpa.

### **5.3. Cross Ties**

Cross ties shall generally be run between opposite manifolds. Where there is only a manifold on one side, or no manifold, and a cross tie is desirable, the cross tie may be tapped directly off the main as shown on drg 092000 / 02.

The size of cross ties is to be determined by system capacity calculations but should be between the limits of 20 mm and 40 mm diameter.

Most cross ties will be via underline crossings and should be combined with cable route underline crossings wherever possible (Refer to Standard Specification SCP 21). Where overhead structures are available (Eg Road bridges), the Superintendent may, if there is no reasonable alternative, permit these to be used to support cross ties.

Preferably, cross ties shall be flexible PVC air hose protected in 100 mm Class 12 rigid PVC conduit for underline crossings and galvanised steel pipe for crossings over structures. Alternatively, PVC air hose within galvanised steel trough or cable tray may be used on structures.

Where steel pipe is used for an overhead cross tie, it must be separated from the steel main by at least 2.0 metres of flexible PVC air hose.

### **5.4. Manifolds**

All connections to pneumatic equipment shall be manufactured in accordance with the requirements of clause 6.5.

### **5.5. Reservoirs**

The use of reservoirs, other than at compressor installations, is to be avoided as far as is possible. Where a small reservoir may be of advantage to the system, the additional capacity can be provided by a local increase in steel main size (75 mm diameter maximum). For example 10 metres of 75 mm pipe in a 25 mm main would equate to a 40 litre reservoir.

When a reservoir is necessary to maintain system capacity, it shall comply with AS 1210. In all cases the reservoir shall be connected to a branch off the main, or off each main in the case of a ladder system, and stop valves shall be fitted at each end of each branch.

The manifold connection at the reservoir shall be of all welded construction with flanges to accept the stop valves.

Where connection is made to an existing reservoir, all components up to the reservoir flange (or connection) shall be renewed.

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## 5.6. Branch Mains and Sub -Mains

Branch or sub mains supplied from one end only and feeding more than one item of equipment are generally not acceptable.

EXCEPTION:- In an automatic section only, a branch or sub-main supplied from one end may feed a maximum of two (2) trainstops facing in the same direction on the same track.

Branch or sub-mains shall not be smaller than the following sizes.

For a maximum of two train stops                      15 mm

For more than two train stops                              20 mm

For points or train stops and points                      25 mm

Branch/sub main connections to the main shall generally be as shown on drawing 092000 / 02

## 5.7. Auxiliary Air Outlets

Auxiliary air outlets consisting of a 15 mm control valve and male BSP connection shall be provided at each equipment connection manifold, within each electricians depot or workshop and within the relay and/or power supply rooms listed in the Particular Specification.

## 5.8. Low Pressure Alarms

Low pressure alarms, as specified in clause 7.11 shall be fitted within each relay and/or power supply room and on each compressor reservoir.

## 5.9. Drainage of Condensate

Provision for the removal of accumulations of condensed moisture in the air lines shall be included in the design. As a minimum, automatic drains shall be provided at all natural low points in surface lines and at the interface between buried and surface lines.

In-line separators shall also be fitted between reservoirs associated with compressors and mains, adjacent to the junction with the main.

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## 6. COMPONENTS AND MATERIALS

### 6.1. Steel Lines

Steel surface lines shall be constructed from galvanised steel medium pipe to AS 1074 and threading shall conform to AS 1722 Part 1.

The diameters of lines shall generally be as determined by the system capacity requirement but mains shall not be less than 25 NB or more than 75 NB and cross ties not less than 20 NB or more than 40 NB. Sub mains or branches shall not be less than 20 NB when feeding points and not less than 15 NB when feeding train stops. Lines to auxiliary outlets shall not be less than 15 NB. (NB = Nominal Bore)

### 6.2. Flanged Joints

Flanged joints in steel lines shall be made with forged steel flanges to AS 2129 Table E and bolted together to the requirements of AS 2528.

All flanges, whether screwed or welded to pipes shall be galvanised to AS 1650 with a coating weight of 450 g / sq m. With welded flanges, galvanising shall be after fabrication.

Gaskets or proprietary compounds may be used to seal flanged joints provided that the product used is environmentally stable and has an unlimited service life while undisturbed.

### 6.3. Insulated Joints

Insulated flanged joints, to be provided where specified in Clause 7 shall use an insulating plate which is at least equal in outside diameter to the flange. Bolts shall be insulated from both flanges. Insulating materials shall be environmentally stable and have an unlimited life while undisturbed.

### 6.4. Expansion Joints

Expansion joints shall be flange mounting and be fitted with stainless steel bellows.

Expansion joints shall be located so that no more than 75% of the linear movement capacity of the joint is required to meet the full range of pipe expansion or contraction.

### 6.5. Control Manifolds

Control manifolds generally shall be manufactured in accordance with the typical layout shown on drawing 092000 / 01-1. No more than eight (8) outlets may be accommodated on any one manifold. However, where only a single train stop is to be fed this may be tapped directly off the main or sub-main as shown on drawing 092000/01-2

### 6.6. Filters and Lubricators

Filters shall be provided in each manifold where shown on drawing 092000/01-1

The filter shall include an automatic drain and shall have a metallic bowl with sight glass. A guard shall be provided around the bowl to prevent unauthorised removal. The guard must be

made of corrosion resistant material such as stainless steel and must require tools for removal.

Lubricators will not normally be required in the air reticulation system since this is built into the pneumatic equipment. However, there may be instances where a lubricator is to be fitted

Where specified, the lubricator shall have a minimum capacity of 0.2 litre, transparent bowl or metallic bowl with sight glass and shall be protected against unauthorised adjustment or filling.

## 6.7. Separators

In-line separators fitted between flanges shall be provided in the feed line from compressor or reservoirs to air main. The drain outlet of the separator shall be fitted with a 15 mm or 20 mm isolating valve followed by a 20 mm bronze strainer and a 20 mm drip leg or auto drain trap.

The cap of the strainer shall be fitted with a 15 mm stop valve for blow down purposes.

## 6.8. Auto Drains

Auto drain traps or auto drip leg drains are to be provided at all low points in the line and at all transitions from underground to surface mains.

The arrangement of these drains and the required isolating and stop valves are shown on drawings 092000 / 04, 092000 / 05 and 092000 / 08.

## 6.9. Valves

All valves whether stop, isolating, blow down, equipment or by-pass, shall be ball valves with stainless steel ball and spindle, PTFE ball seal and packing rings and stainless steel or bronze body.

Stop, Isolating or by-pass valves in main lines and cross tie connections (except within manifolds) shall be flanged, Table E. Valves within manifolds which connect directly to PVC hose shall be female threaded 20, 25 or 40 mm BSP as appropriate.

Blow down and equipment valves shall be female 20 or 15 mm BSP as applicable. Except where the valve is inside a locked building, valve handles shall be removed.

## 6.10. Flexible Air Hose

All flexible air hose, except that used within the City Underground, North Sydney -Waverton Tunnel and Eastern Suburbs Underground lines shall be Class B PVC air hose to AS 2554.

Air hose used in the above listed tunnels shall be of a flame retardant or flame proof material with a working pressure of 900 kpa and a minimum burst pressure of 2800 kpa. Alternatively 15 NB stainless steel flexible tubing may be used for connections to equipment.

The maximum size of flexible PVC hose shall not generally exceed 40 mm diameter. In limited circumstances, such as

- buried lengths of mains to a maximum of 50 metres long
- short lengths where the use of steel is impractical to a maximum of 50 meters long. (Eg Where complex bends or sets are necessary)
- temporary works, 50 mm PVC hose may be used.

Fittings for PVC hoses up to 40 mm shall be brass nut and tail. Two stainless steel "Band-It" or equivalent straps shall be used on 25 and 40 mm hoses and one on 15 and 20 mm hoses.

"Minsup" quick connect malleable iron couplings or equivalent complete with safety chains shall be used on 50 mm hose with two straps.

## 6.11. Pressure Gauges and Alarms

Pressure gauges shall be provided where the air line enters relay and/or power supply rooms and on compressor reservoirs on the reservoir side of the outlet regulator. The gauge shall be not less than 100 mm diameter and shall have a 0 to 1000 kpa full scale dial. The case shall be brass or bronze with a 15 mm bottom entry.

Each gauge shall be fitted with adjustable contacts to provide an alarm indication if the air pressure falls below 400 kpa in air mains and 525 kpa in compressor reservoirs. The alarm contacts shall not interfere with the reading on the gauge

Regulators on compressor reservoirs shall also be fitted with gauges but alarms are not required and gauges may form part of the regulator.

## 6.12. Regulators

Regulators shall be provided on the outlet of each compressor reservoir and where a new system end connects to an existing system. The regulator shall be of the relieving type with gauges. Unless otherwise stated in the Particular Specification, regulators shall be set to provide 480 - 490 kpa in the mains.

## 6.13. Compressors

The certification of air compressors and/or pressure vessels shall be in accordance with the requirements of the Department of Industrial Relations.

Unless otherwise stated in the Particular Specification, compressors shall be electric motor driven units, integral with the reservoir except where the output required exceeds the capacity of this form of construction. Motors shall either be single phase 240 v 50hz or 3 phase 415v 50hz and be rated for continuous duty.

The compressors are to be capable of pressures to 1000 kpa and pressure switches are to be adjusted so that normal operation is between 550 and 750 kpa.

All compressor units are to be mounted on vibration isolators and are to be coupled to the air main via a length of stainless steel flexible metallic tubing.



Where the installation justifies the use of two compressors at one location, they shall be arranged to "lead" and "lag" with facility provided to change the lead from one compressor to the other.

Typically a twin compressor installation shall be as shown on drawing 092000/10

## 6.14. Orifice Plates

Orifice plates will be required at all connections between 15 mm flexible hoses (to equipment) and manifolds. The size of orifice shall be 1.6 mm if the connection is to a train stop and 3.2 mm if the connection is to a points motor or control valve.

Orifice plates shall also be required where the system end connects to any existing system and at other strategic locations within the system to prevent total loss of pressure in the event of a main fracture. The size of the orifice will depend on system loading and plate location. In these cases the orifice plate shall be fitted with a normally closed by-pass valve for rapid re-pressurisation of the line after repairs are effected. The valve shall be 15 mm or twice the size of the orifice plate, whichever is larger.

## 7. SYSTEM CONSTRUCTION

### 7.1. Steel Surface Mains

Steel surface mains shall normally be supported approximately 300 mm above ground level on steel posts at 3000 mm intervals. The height of the main may however be varied within the limits of -200 and + 500 mm to maintain a level or constantly sloping route.

Posts shall be 100 x 50 x 10 channel to AS 1131 - 1979, hot dip galvanised to AS 1650 - 1989. The posts shall be not less than 500 mm in ground, except in rock, and the bottom 400 mm of the post shall be set in concrete. The depth of post in hard rock (eg Hawkesbury sandstone) shall be 150 mm minimum.

Where space does not permit the use of posts or the posts would interfere with drainage or other ARTC requirement, the air main may be fixed to cutting walls, retaining walls or other structures with the written approval of the Superintendent.

Where attachment is made to retaining walls, concrete bridges or other masonry structures, "Chemset" grade 316 stainless steel chemical anchors or equivalent shall be used. Expanding type masonry anchors will normally not be approved.

Except at anchor points, the brackets supporting the main shall allow axial freedom for expansion and contraction but shall not permit vertical or lateral movement exceeding 5 mm (2 mm either side of expansion joints).

The bracket shall be manufacture from hot dip galvanised steel except that in City Underground and Eastern Suburbs tunnels it shall be manufactured from Stainless Steel to AS 1449. Acceptable bracket designs are shown on drawing 092000 / 08

Air main pipe joints shall be threaded except at connections to stop or isolating valves, manifolds, reservoirs, transitions from surface to buried main and at insulated joints where flanged joints shall be used.

**Steel air mains must never be attached to overhead wiring structures or signal gantries. A minimum clearance of 75 mm must be maintained between the air line and any overhead wiring structure or signal gantry.**

**Wherever practical steel air main should be placed two metres from any overhead wiring structure or signal gantry.**

## 7.2. Anchor Points

Anchor points shall be provided on surface steel mains:-

- a) Every 300 metres on straight runs. (500 metres in City Underground, Eastern Suburbs tunnels and North Sydney to Waverton tunnels)
- b) Where the main enters/leaves a pit
- c) Where a steel branch, sub main or steel cross tie intersects with the main.
- d) To restrict the movement of any manifold to 25 mm An air main shall be considered to

be straight where:-

- a) It is curved to a horizontal or vertical radius greater than 250 metres.
- b) There are minor offsets of 900 mm maximum around abutments or structures.

The offset shall preferably be formed by bending the pipe at 45 degree angles in place of 90 degree angles and shall be free to move in the axial direction of the line.

Where there are larger offsets or changes of direction the line shall be anchored in both directions as shown on drawing 092000 / 03

Generally anchors should consist of two standard posts set 500 mm apart in a common concrete base and diagonally braced with two 50 x 10 steel bars. The pipe shall be fixed to each post with two (2) galvanised U bolts. A typical anchor point is shown on drawing 092000 / 03.

Existing buildings, structures and retaining walls shall not be used as anchor points without express permission. The maximum anticipated loading on the anchor point must be advised when requesting permission.

## 7.3. Expansion Joints

Expansion joints shall be installed in surface steel pipe to provide for axial pipe movements of 85 mm per 100 metre length. The assumed temperature range is 0 - 80 degrees C (except

in tunnels 5 to 40 degrees C) and pipe temperature is to be measured at installation to ensure that the expansion joint is expanded to match that temperature when installed. Expansion joints shall be installed between all fixed points on the steel pipe (Eg anchor points, major changes of direction, connections at pits.)

The pipe shall be supported within 1 metre each end of an expansion joint and shall be accurately guided for at least four (4) metres in each direction. Where the expansion joint is located in a curved section of pipe, a straight shall be formed to extend 5 metres either side of the joint.

## 7.4. Underground Steel Mains

Generally the use of underground steel air main is to be avoided except where the buried length exceeds the permissible maximum length of 50 mm PVC flexible air hose.

Where use of underground steel main is necessary it shall be constructed from the same size and type of pipe as surface mains but the pipe shall be protected with an extruded polyethylene sheath to AS 1518. Screwed joints in the pipe shall be protected by heat shrink sleeves or well lapped polyethylene tape which has been pre-coated with pressure sensitive adhesive. Joints shall be tested and proven leak free prior to fitting sleeves or taping and installing in ground.

Underground air main shall never be directly buried but shall be installed in 100 mm (or 150 mm in the case of 75 mm main) Class 12 Rigid PVC conduit to AS 1477 Part 1. The conduits shall terminate in pits as shown on drawing 092000 / 04 and the topmost conduit shall be either 800 mm below ground level or 1600 mm below rail level in an under track crossing. Conduit joints shall be solvent welded in accordance with AS 1477 Part 5.

Care shall be taken to ensure that the polyethylene coating on the steel pipes is not damaged during transport and installation. Damage of a minor nature may be repaired with heat shrink sleeves or tape wrapping with the approval of the Superintendent. No damaged pipe shall be installed without repair.

Steel mains shall not be installed in the same duct or trench as signalling , power or communications cables unless the cables are run in PVC conduit(s).

If the main is in the same trench as cables, insulated joints shall be provided at 100 metre intervals.

## 7.5. Flexible Air Lines

PVC air hose:-

- Shall preferably be used where underground air lines are required;
- Shall always be used for the connection between manifold and pneumatic equipment (except in the City Underground and Eastern Suburbs Tunnels) and
- May be used for mains and branch or sub - mains on isolated, lightly loaded systems or, if specified in the particular specification, where a system covers a small geographic area and has a known limited life expectancy.

Where used for cross ties or in under-track or under-road air main crossings, the hose shall be installed in 100 mm diameter class 12 rigid PVC conduit. Joints in the air main within conduits shall be avoided as far as possible.

Hose connections to equipment within 5 metres of a manifold shall be run on the surface within a flexible orange coloured PVC conduit. If the equipment is more than 5 metres from the manifold, the hose and conduit shall be buried 800 mm below ground from immediately under the manifold to within 1 metre of the equipment. Buried conduit may be black in colour. The conduit is to be carried to within 100 mm of the connections at each end of the hose whether buried or surface.

Joints in flexible air hose are to be minimised and are not permitted underground (except where the maximum manufactured length is insufficient, in which case the joint shall be made in a pit), or in hose lengths of less than 50 metres. Minimum bend radii shall not be less than twelve (12) times the nominal hose diameter.

Flexible air hose shall not be installed in the same conduit as cable but may be buried in the same trench or laid in the same trough provided the air hose is laid on top of the cables and joints are covered with heat shrink sleeves (NB Naked flame must not be used to shrink sleeves - use hot air gun only) or taped. Hoses must be pressurised to 700 kpa and tested for leaks or separation between construction layers before trenches are backfilled or troughing covers fixed. Hoses shall also be pressurised to 700 kpa during backfilling of trenches.

## 7.6. Drainage of Underground Air Line

Underground mains, sub mains cross ties etc shall be as straight as possible and wherever practicable shall have at least a 1% fall between highest and lowest points.

The low point shall be fitted with an automatic drain, as shown on drawings 092000 / 04, 092000 / 05.

## 7.7. Insulated Joints

Insulated joints in steel mains shall be placed

- a) Between the main and any compressor or reservoir.
- B) Where the main enters or leaves the ground or a pit
- c) Within one (1) metre of each end of any steel bridge
- d) Every 500 metres in straight route. This joint is to correspond with the insulated joint in steel troughing routes if the air line is supported on the same posts as the troughing.

Where the air line is within two meters of an overhead wiring structure which is not fitted with a spark gap, the line is to be covered with an insulating sleeve (rigid class 9 - 12 PVC conduit is acceptable) for a distance of two metres either side of the structure. Suitable clamps or clips are to be provided each end of the sleeve to prevent movement.

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## 7.8. Valve Labelling

All valves shall be labelled with permanent non-fade labels. The information required on each type of valve is

Equipment control valves - the type and I.D. of the equipment, eg. "222 XOVER NTH END", "333 PTS", "SY456S TS"

Stop or isolating valves on mains, cross ties, manifolds, drains etc Normally open valves "N.O.", normally closed valves "N.C."

Stop valves on sub-mains - the equipment fed from the sub-main, eg. "SUB MAIN 111 PTS, 113 PTS, 444 TS"

Stop valves at reservoirs and compressors - the distribution main and its direction Eg. "DOWN MAIN WEST"

## 8. STAGE WORK AND TEMPORARY WORK

### 8.1. Stage Work

Where an air reticulation system is being replaced and the size of the work dictates that the new system will be brought into use in stages and has to be temporarily fed from the existing system, then each stage is to be individually tested for leakage and brought up to working pressure prior to any connection to the existing system.

### 8.2. Temporary Work

Where temporary air lines, generally flexible PVC, are required they shall be protected against damage either in flexible PVC conduit or where crossing tracks, roads, pathways, in Class 12 UPVC pipe shallow trenched into the ground (or ballast) and covered with earth (or ballast).

## **9. CONNECTION TO AN EXISTING SYSTEM**

Where a new system is end connected to an existing system or is a branch from an existing system, the new system shall be fully leak tested then brought up to working pressure with either its own or an independent compressor before being connected to the existing system.

The existing system shall not be used to either test or initially pressurise the new.

For an end on connection, a stop valve shall be provided on the end of the existing system followed by an orifice plate and by-pass valve. The orifice plate is to be sized so that there is adequate flow for the new system load, but insufficient to deplete the existing system.

For a branch, stop valves shall be provided either side of the connection together with one on the branch.

## **10. INSPECTION AND TESTING**

### **10.1. Inspection**

Underground lines whether in rigid or flexible conduit shall be inspected and approved by the Superintendent or his representative prior to trenches being backfilled. Pits shall be in place and pipe work connections made before the inspection takes place.

### **10.2. Testing and Certification**

Upon completion of the system or each separable stage, it shall be tested in the following manner using either its own or an independent compressor:-

- a) With all equipment control valves closed, the system shall be brought to a pressure of 700 kpa. The time taken to reach this pressure from a compressor of known output is to be recorded and the system is to then be isolated for a period of 8 hours and the pressure drop measured.

To be accepted, the system shall not lose more than 15 kpa per hour

- b) This test shall be repeated with equipment control valves open.

To be accepted, the system shall not lose more than 20 kpa per hour.

(NOTE:- Where staging existing pneumatic equipment onto a new air system, this test is not required.)

- c) On a random basis one equipment air outlet valve on manifolds is to be disconnected from the hose to the equipment and opened for 1 minute.

The filter on that manifold is then to be removed and examined for contamination.

No contamination (other than minor evidence of oil or water) is permissible.

Upon satisfactory completion of testing, Acceptance Certificate 092000A1, shown in Appendix A shall be filled in by the Contractor and forwarded to the Superintendent at least 7 days prior to commissioning of the works.

Within 14 days of commissioning of the work, the contractor shall complete all Air Reticulation System details on Site Survey Drawings and forward them to the Superintendent.

## 11. Appendix A - Acceptance Certificate



**Australian Rail Track Corporation**  
**Specification SCP 19 - Air Reticulation Systems**

**Acceptance Certificate 092000**

A1 Page ...of.....pages

Particular Specification No : .....

Contract No: ..... From ..... km To..... km

| SYSTEM COMPONENT                               | INSPECTED / ACCEPTABLE      |                                 | DATE | LOCATION<br>Kilometers |
|--|-----------------------------|---------------------------------|------|------------------------|
|  | Contractors Representative* | Superintendents Representative* |      |                        |
| AIR MAINS                                      |                             |                                 |      | From .....             |
| MANIFOLDS<br>Including Valves and fittings     |                             |                                 |      | At<br>At<br>At         |
| CROSS TIES<br>Including Valves and drains      |                             |                                 |      | At<br>At<br>At         |
| AUTO DRAINS                                    |                             |                                 |      | At<br>At               |
| SEPARATORS AND STRAINERS                       |                             |                                 |      | At                     |
| INSULATED JOINTS                               |                             |                                 |      | At<br>At<br>At         |
| FLEXIBLE HOSES                                 |                             |                                 |      | At<br>At<br>At         |
| PRESSURE GAUGES                                |                             |                                 |      | At<br>At               |
| COMPRESSORS & RESERVOIRS<br>Regulator          |                             |                                 |      | At<br>Pressure:-       |
| ANY OTHER FITTING - Nominate<br>.....<br>..... |                             |                                 |      | At                     |
| SYSTEM TEST ##                                 |                             |                                 |      | From .....             |

It is hereby certified that that the stated section(s) or components of the Air Reticulation System have been inspected and tested and comply with the requirements of Specification 092000 and the Particular Specification.

Contractors Name : .....

Contractors Representative : .....Date: .....









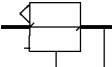
ARTC Representative : .....Date: .....

\* Insert Tick if acceptable

## This section to be completed once only for each separable part or stage of the work

## 12. Appendix B - Drawings

## Pneumatic Symbols Used in Drawings

|  |                             |
|--|-----------------------------|
|   | Ball Valve M or F Thread    |
|   | Auto Drain with Filter      |
|   | Union                       |
|   | Ball Valve flanged coupling |
|   | Flanged Coupling            |
|   | Welded Joint                |
|   | Orifice Plate               |
|   | Insulated Flange Joint      |
|  | Regulator                   |

## Abbreviations Used in Drawings

|    |                                |
|----|--------------------------------|
| NO | Normally Open                  |
| NC | Normally Closed                |
| NB | Nominal Bore (Steel pipe size) |



