Specification No. ELRS/SPEC/PBS/0034,Rev. '1'

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

सत्यमेव जयते

TECHNICAL REQUIREMENTS OF TRI-PLATE PANEL MOUNTED IRAB-9 & IRAB-10 BRAKE SYSTEM FOR WAP-4 & WAG-7 ELECTRIC LOCOMOTIVES

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1.0 Foreword :

1.1 This specification deals with tri-plate panel mounted IRAB-9/IRAB-10 pneumatic brake equipment for WAG-7/WAP-4 Electric Locomotives. At present, brake system being used on WAG-7/WAP-4 Electric Locomotives manufactured by Chittaranjan Locomotive Works are IRAB-9/ IRAB-10. It is proposed to provide panel mounted air brake system in place of existing arrangement of mounting of various valves at different locations and connecting them with piping arrangement. In IRAB-9/IRAB-10, RDSO have developed pure air brake system to delete vacuum related portion from basic design of 28 LAV-1 brake system to facilitate hauling of air braked freight and passenger stock. With adoption of tri-plate pneumatic brake panel, following advantages when compared to existing arrangement would be available.

1.1.1 Reduction of piping net work and related pipe fittings.

1.1.2 Reduction in man-hours during the manufacturing and maintenance of locomotives due to elimination of mounting of individual valves and their inter connecting piping works.

1.1.3 Attention of brake equipment for maintenance and trouble shooting is easier.

1.1.4 Concept of unit exchange can be easily adoptable.

1.1.5 As the most of the valves and other brake related equipments are mounted in close proximity to one another on the same panel, the air leakage would be drastically reduced and due to lesser leakage the braking response will be better.

1.1.6 Number of pipe bracket are minimized.

1.1.7 Reduction in weight when compared to total weight of the equipments and piping in conventional system.

1.2 Any deviations from the requirements stipulated in the specification shall be clearly brought out by the tenderer while submitting the offer. In the absence of such specific information regarding deviations, it will be presumed that the offer complies exactly with the stipulated requirements. As far as possible, the tenderer shall make only one offer to suit the exact requirements given in the specification. However, where, for technical reasons the tenderer proposes an offer which in his opinion is superior, he may do so, giving the relevant techno-economic details.

1.3 Panel manufacturers before undertaking prototype production shall furnish detailed, design data for scrutiny to RDSO for approval of design by RDSO. RDSO's approval will be only for the purpose of standardization and reliability assurance, not withstanding RDSO's approval to the design/prototype, it shall be the panel manufacturer's responsibility for satisfactory performance of brake system and warranty obligation under the contract will not be affected.

The supplier shall be responsible for any damage to the equipment due to defective design, material, workmanship up to a period of 36 months after commissioning or 40 months from the date of supply. The supplier shall be responsible to replace all such equipment during warranty period at his own cost.

1.4 For ensuring satisfactory design and operation of the brake panel, it is necessary for the panel manufacturer to consult the air intake condition of the compressed air. It shall be the responsibility of panel manufacturer to get necessary details from compressor, air dryers and other related equipment manufacturers directly from the firm supplying the above equipments.

2.0 **SCOPE :**

This Specification covers the general design, layout, inspection, testing, installation and commissioning of panel mounted IRAB-9 for WAG-7 and IRAB-10 for WAP-4 air brake system for Electric Locomotives.

2.1 The WAG-7 Electric Locomotive is equipped with 3 nos. 1000 LPM or 2 nos. 2000 LPM compressor and WAP-4 locomotive is equipped with 2 nos. 1000 LPM compressor delivering pressure at 10 kg/cm^2 or 2 nos. underslung compressor of 1500 LPM

3.0 **Operating Requirements :**

The air brake system shall generally be in accordance with RDSO's brake Schematic diagram No. SKDP-2610 for WAG-7 class of Electric Locomotive and SKDP -3241 for WAP-4 class of Electric Locomotive and shall be suitable for twin pipe graduated release type air braked stock. The brake equipment should be of WABCO design and shall generally conform to WABCO drawings and specifications. Equipment which are not of WABCO design shall be got approved by RDSO.

Some of the special requirements :-

3.1 The panel shall have provision for using it for pure air brake WAP-4 and WAG-7 class of Electric Locomotives.

3.2 The brake equipment to be mounted on the panel shall be as per list given in Annexure-I.

3.3 The panel is to be mounted in side the engine room, may be by the side of compressor having continuous vibration so, proper mounting strength is required.

3.3 The over all size of the panel shall not be more than 1500 mm in height, 1000 mm in length and 420 mm in width.

3.4 The mounting hole dimensions should be as per mounting arrangement shown in **ANNEXURE - II.**

3.5 All the brake equipment provided on the panel will be without pipe brackets and the main panel block shall serve the purpose of pipe bracket for all the brake equipment, so that individual valves can be removed from the panel for easy maintenance and approachable.

3.6 The air connections to the individual valve on the panel shall be made through the main block by milling operation. Inlet and outlet connection is to be provided at the bottom of the panel with a special design of manifold connection with standard nipple arrangement to match the connection as per RDSO's schematic diagram SKDP-2610 for WAG-7 class of locomotives and SKDP-3241 for WAP-4 class of Electric Locomotives.

3.7 The air inlet and outlet connection should have interchangeability facility with other makes of panel without changing any major change in pipe line connection and the nipple sizes are to be standard for other manufacturer's panel.

3.8 The panel should be of simple design, light in weight, robust in construction and the mounting base holes are to be inter-changeable with other makes of panel to be ensured. .

3.9 The port sequences and nipple sizes of inlet and outlet ports should be as per **ANNEXURE- III.**

3.10 The panel should be suitable for working at a pressure of 10 kg/cm^2

3.11 Internal passage layout diagram is to be submitted to RDSO and it should be as straight as possible to reduce pipe losses and flow area shall not be less than the port area of the corresponding valve.

3.12 The panel shall be made from corrosion resistant material and painted with light gray as per IS: 5 clause 631 and the reservoirs are to be painted with black enamel paint.

3.13 The panel shall be made of such material that it should not be affected by oil carry over with compressed air.

3.14 Ports between valve and panel plate shall have gasket / '0' rings to make joint leak proof.

3.15 To avoid mismatching of valve ports and panel ports a suitable arrangement of dowels shall be made.

3.16 The equipment mounted on the panel shall have sufficient space between two adjacent equipments for easy maintenance and trouble shooting.

3.17 Test ports shall be provided at appropriate location of the panel to measure pressure at critical points for easy identification during rectification and proper functioning of vales as and when required.

3.18 The frame shall be provided with robust design of lifting arrangement for mounting and removal of the panel with the help of overhead crane as well as for sliding of the panel in and out of the locomotive.

3.19 The equipments name plates, port identification name plates, cut-out cock position plates shall be of anodized aluminum with engrave/embossed letters and fixed up by screws or riveting. Pasting the nameplate is not acceptable.

3.20 For electrical connection cables shall be of elastomaric or E-beam cable confirming to RDSO's Specification No. ELRS/SPEC/ELC/0019/Rev. '0' of May-2002 and insulated lugs of standard size are to be used. All the cables and terminal blocks are to be properly numbered. The firm shall submit wiring diagram along with the offer.

3.21 The terminal blocks should not be less then 20 blocks and to be mounted at the height of 600mm from the base of the panel frame. The wiring diagram and cable numbering are to be as per **ANNEXURE –III.**

3.22 Cables are to be properly harnessed and secured on panel frame by providing cable-supporting stiffener and tied up with nylon ties. Plastic tapes and ties are to be avoided.

3.23 Air filters shall be provided at suitable location at air inlet connection of panel to prevent entry of dust and dirt from piping. It shall be possible to clean these filters without disturbing the panel or any equipment and inlet connection to panel.

3.24 Rubber components used in all the brake equipment including those mounted on the panel shall either conform to IRS R–48-88 or WABCO specifications and shall be obtained only from RDSO approved sources.

3.25 Since the valves mounted on panel would be removed periodically for maintenance, the threads on the panel plate for fixing the valves may wear out or get damaged. The supplier shall provide necessary arrangement and furnish complete details of the same against such damage to threads. The supplier may consider Heli inserts for use in the mounting plate.

3.26 The supplier shall ensure that it is possible to clean grooves in the panel plate either by blowing through or any other method in case of blockage of passage inside the plate. The arrangement and the procedure for cleaning shall be indicated in the offer.

3.27 Suitable arrangement for drainage of the condensate shall be provided.

4.0 <u>Service Conditions</u> :

4.1 The equipment shall be capable of operating satisfactorily under conditions of dust, dirt, moist torrential rains, sand storm and presence of oil vapours to which the locomotive is normally exposed in service and vibration encountered in rolling stock operation on Indian Railways.

4.2 The equipment shall be capable of working satisfactorily under the following conditions :-

i)	Ambient temperature	-	0^0 to 55^0 C
ii)	Maximum temperature inside the equipment compartment may be reached up to	-	70^0 C
iii)	Relative humidity	-	0% to 100%
iv)	Altitude	-	1200 m above mean Sea level to

4.3 The panel with mounting arrangement shall be able to withstand the vibration and shocks as per clause 'A' category 1 of IEC 61373. Any special anti-vibration mounting if required shall be specifically indicated by the tenderer and supplied as a part of the unit. The vibration and shock test is to be done to the actual operating condition.

5.0 <u>Installation</u> :

5.1 Installation and commissioning of the panel on the first prototype shall be the responsibility of the supplier. Other equipment except Annexure - 'I' in accordance with RDSO's Schematic Drg. No. SKDP-2610 for WAG-7 & 3241 for WAP-4 class of Electric Locomotives shall, however, be installed by the purchaser. Assistance with regard to labour and other facilities which are available in the workshop would however, be provided by the purchaser to the supplier. Additional equipments/fittings not covered in this specification, if required, for installation of panel shall be supplied by the supplier.

5.2 The supplier shall submit tentative installation drawing along with the offer, based on the availability of space in locomotive. These drawings would however, be finalized after fitment of the first prototype.

6.0 <u>Testing & Inspection</u> :

6.1 Whenever, a new type of panel is offered by supplier, a panel shall be subjected to a series of tests to evaluate the performance and establish its reliability.

6.2 Supplier shall submit the complete test protocol for testing of sub-assemblies as well as complete assembly of the panel. The test scheme should clearly indicate the type as well as routine tests to be carried out. The test protocol shall be got approved by RDSO prior to the commencement of tests.

6.3 Supplier shall arrange ultrasonic "C" scanning of the panel to establish consistency of the bonding of the plates and manufacturing process, if applicable.

6.4 Vibration test should be conducted at least in two prototype sample and at least one panel should be "C" scanned before and after vibration test, if applicable.

6.5 Supplier shall submit the complete bonding process of the panel as well as bonding material with specification.

6.6 Individual brake equipment would be tested by RDSO or its representative as per the standard test procedure of M/s. WABCO /RDSO including those being installed on the panel.

6.7 Tests shall be conducted to check the performance of panels at air pressure of 10 kg/cm^2.

6.8 All tests shall be conducted at manufacturers premises at no extra cost. Any shortcoming or defect noticed during the type test shall be pointed out to the manufacturer by the purchaser or his representative to enable him to incorporate the necessary improvements before bulk manufacture is commenced without affecting the guaranteed performance characteristics.

The detailed test scheme for the type and routine test shall be decided jointly by RDSO / purchaser and the manufacturer at the time of finalization of the contract.

6.9 Any additional test, trials, if considered necessary by RDSO shall also be arranged by the supplier free of cost.

6.10 The purchaser/ RDSO or their representative shall have access for stage inspection to those portion of the manufacturers works in which production is being carried out and where the testing is taking place. This also applies to the items procured from sub-contractors by the suppliers.

6.11 The inspection officer shall have the power to adopt any means he may consider necessary to satisfy himself that proper materials and parts specified are actually used during the manufacture of the unit.

6.12 The supplier/manufacturer shall provide labour or appliances required by the inspecting officer free of charge, for inspection and testing of the complete panel and its components, if required.

6.13 Should any equipments of the panel require alteration or any defect appear during the tests or trials, the supplier shall without any extra charge, make such alternation or rectify the defects to the satisfaction of the purchaser / RDSO or his representative.

6.14 Any modification or alteration to the components shall be made only after the approval of the RDSO. The panel after such modification / alterations shall be subjected to such tests as considered necessary by the purchaser/ RDSO.

6.15 The type test will be performed on one/two units of given design to verify the product to meet the requirement. Some or all the type test shall be repeated one in two years by RDSO/Purchaser on sample basis so, as to conform the quality of the product. In addition, the manufacturer shall repeat all the type test after 5 years without any additional cost.

6.16 The type test will also be repeated in the following cases:-

- Modification of equipment which is likely to effect its function.

- Failure or variation during type /routine test
- At the time of indigenisation if the firm has supplied the original product with foreign collaboration.

7.0 Guarantee :

The equipment shall work satisfactorily for a period of 36 months after commissioning. However, the supplier shall guarantee for any design defects arising for at least 10 years. Any equipments which fails during the guarantee period shall be replaced or modified free of cost by the supplier. In case, it becomes necessary to modify the design, all the panels will have to be modified by the supplier free of cost. If any modification is required in design full details has to be submitted to RDSO for further approval.

8.0 Tool Kit :

8.1 If any special tool kit is required for maintenance, the supplier shall be supplied a set of tool kit with every panel as a part.

8.2 The price for tool kit, when procured independent of the order, shall also be indicated with offer for panel.

9.0 Technical Documents / Drawings :

9.1 The tenderer shall supply copies of exhaustive, fully illustrated manuals, both in hard copy and digital form mostly covering among other items, the following vital details to RDSO and purchaser:-

i) Description and arrangement.
ii) Technical data
iii) Dismantling and assembly instructions.

iv) Commissioning instructions.

v) Periodical inspection schedules.

vi) Periodical maintenance instruction along with equipments overhaul schedule and trouble shooting instructions.

vii) Testing procedure for the equipments and other like pressure switch, magnet valve, filters, isolating cocks etc

viii) Detailed parts catalogue with description of items. The parts shall be detailed by sketches to facilitate ordering.

ix) List of special tools with instructions for use.

9.2 Detailed dimensional drawings indicating mounting arrangements, layout of valve, sub assemblies etc.

9.3 Clause wise comments on specifications.

9.4 Test programme and details of testing facilities at manufacturer's works.

9.5 List of recommended spares for maintenance of panel mounted brake equipment for two years.

9.6 Latest copy of bill of material of all brake items with drawing no. of individual components.

9.7 The supplier shall submit quality assurance plan (QAP) to be followed by the supplier, to ensure control on the quality of the equipment.

9.8 M.O.U. (Memorandum of understanding) with the collaborator, whenever applicable.

9.9 ISO 9000 certification

9.10 One copy per set of the following documents shall be supplied by the supplier as part of contract :-

i) Type and routine test specification and test reports

ii) Maintenance instructions covering description, operation of complete system and individual valves, disassembly and assembly, trouble shooting, test specification of individual items and complete panel mounted equipment, spare part catalogue and recommended lubricants.

10. **Deviations :**

The supplier shall submit list of deviations, if any, with reasons there of.

11. **Approval of Sub-Contactors :**

The firm shall obtain components, sub assemblies and assemblies frame sources approved by RDSO.

12. Infringement of patent Right :-

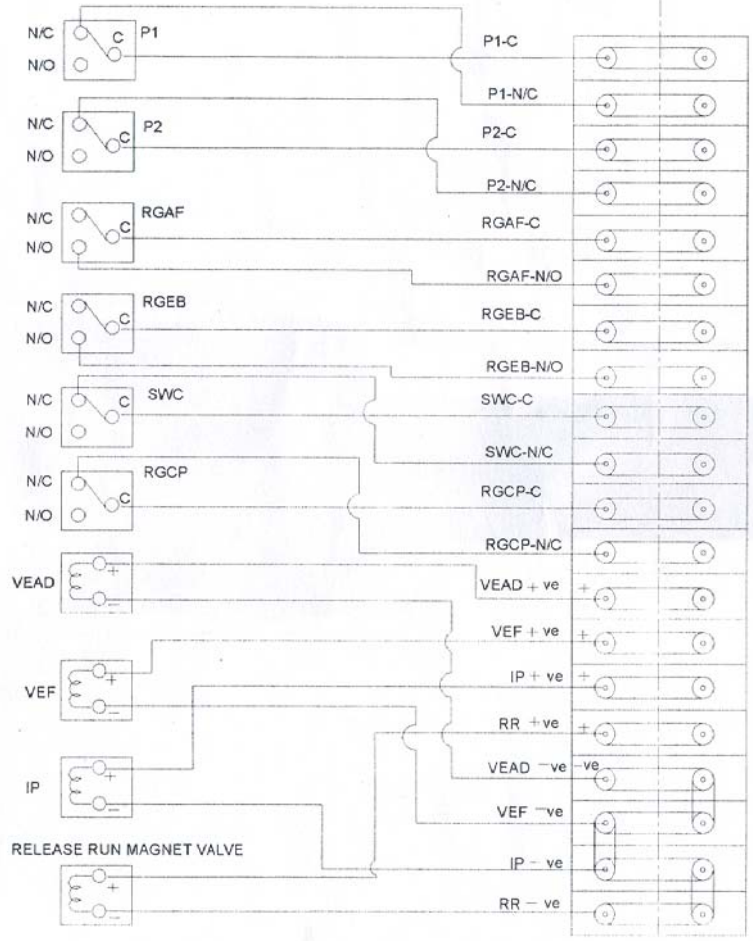
Indian Railway shall not bear any responsibility for infringement of any patent/ copy rights arising due to any similarity in the design etc.

ANNEXURE -I

LIST OF EQUIPMENT TO BE MOUNTED ON PANEL

S.No.	Item	Item as per SKDP 3241	No. per Panel
1.	MU-2B Valve	C-18	1
2.	F1 – Selector Valve	C-17	1
3.	R-6 Relay Valve	C-4	1
4.	C2W Relay Valve BC	C-14	1
5.	C2W Relay Valve with 6 mm Choke in Ex.	C-1	1
6.	Air flow measuring Valve	C-3	1
7.	C3W distribution Valve	C-10	1
8.	N-1 Reducing Valve set at 2.5 kg/cm^2	C-12	1
9.	Feed valve 6 kg/cm^2	C-8	1
10.	Double check valve	C-7	1
11.	IP-Magnet Valve	C-13	1
12.	Release & Run Magnet Valve		1
15.	VEAD Magnet Valve	A18	1
16.	Emergency Application Valve	-	1
17.	Pressure Switch SWC	C-19	1
18.	Pressure Switch RGAF	C-6	1
19.	Pressure Switch RGEB	C-23	1
20.	Pressure Switch RGCP	A-17	1
21.	Pressure Switch GCR	C-27	1
22.	Pressure Switch RGPA	-	1
23.	Pressure Switch P1 4.8 kg/cm^2 /4.5 kg/cm^2	-	1
24.	Pressure Switch P2 4.7kg/cm^2 /4.4 kg/cm^2	-	1
25.	Control Reservoir 2 lit.	C-2	2
26.	Control Reservoir 3 lit.	C-15	1
27.	Control Reservoir 10 lit.	-	1
28.	All the related cut out cocks	-	
29.	Centrifugal Strainers	-	
30.	VEF	A –20	1

ANNEXURE - IV



P1- N/C CONTACT OPEN

BELOW - 4.8 Kg/cm2
CLOSES - 4.5 Kg/cm2

P2 - N/C CONTACT

OPENS - 4.7 Kg/cm2
CLOSES - 4.4 Kg/cm2

RGAF- N/O

CUT IN - 4.O Kg/cm2
CUT OUT - 3.5 Kg/cm2

RGEB- N/O

CONTACT CLOSES - 4.2Kg/cm2

OPENS - 3.0 Kg/cm2

SWC - N/C

CUT OUT - 1.O Kg/cm2
CUT IN - 0.2 Kg/cm2

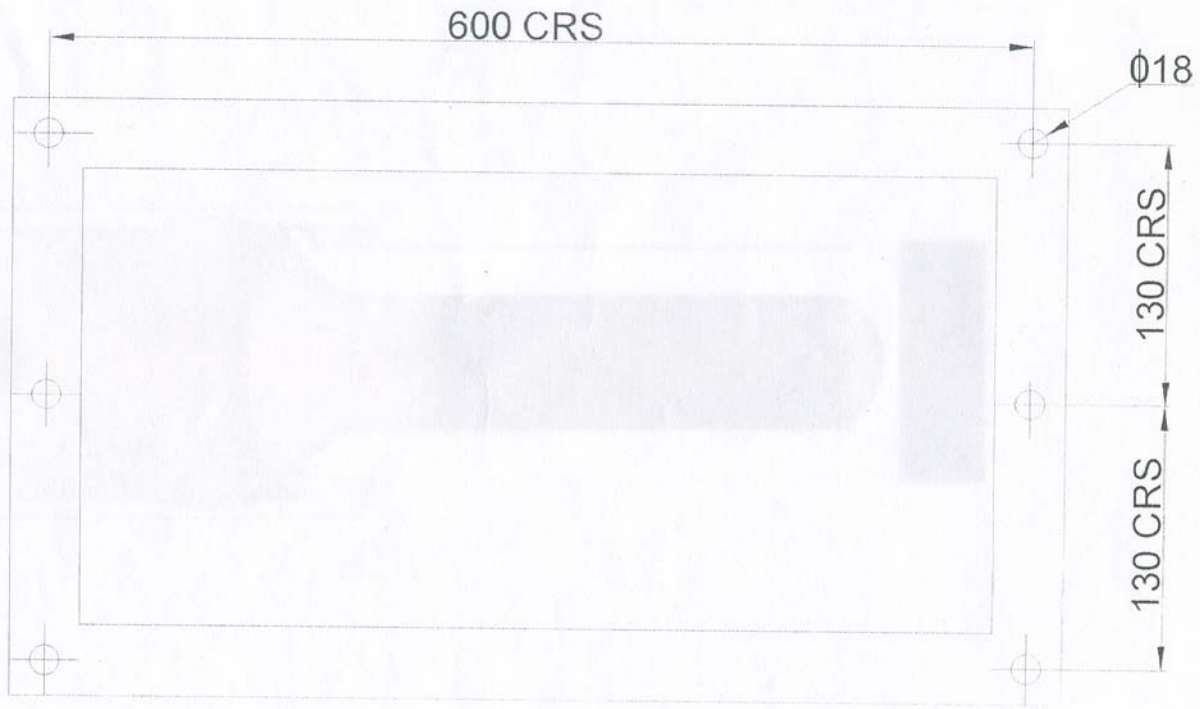
RGCP - N/C

CUT OUT - 9.5 Kg/cm2
CUT IN - 8.0 Kg/cm2

Dt.	21.03.2005
D.	K.P.NIGAM
C.	M.C.Mahant
T.	

IRAB-9 & IRAB10 TRI-PLATE PANEL WIRING DIAGRAM

ANNEXURE - II



NOTE :-
ALL DIMENSIONS ARE IN mm.

Dt.	21.03.2005
D.	K.P.NIGAM
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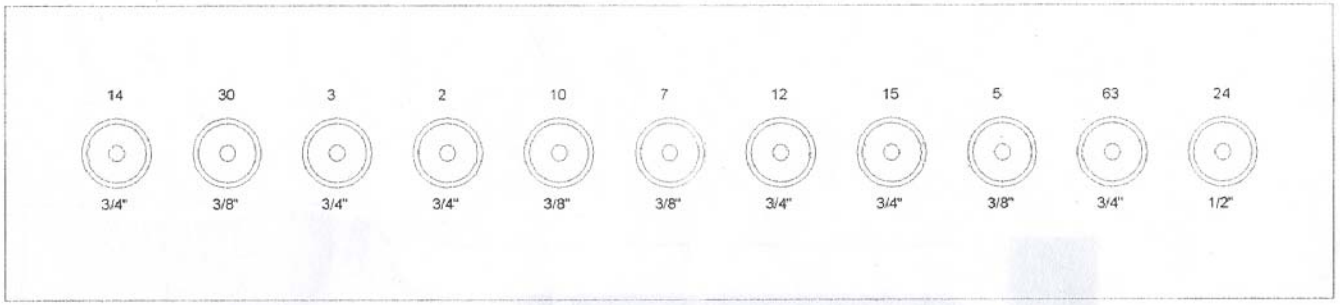
T.	

MOUNTING ARRANGEMENT

ANNEXURE -III



PORT-14 FROM 3rd MR SUPPLY
PORT-30 TO AIR FLOW INDICATION GAUGE
PORT-3 TO BRAKE PIPE
PORT-2 FROM 4th MR SUPPLY
PORT-10 FROM CONTROL LINE PORT 5 OF A9
PORT-7 FROM CONTROL LINE PORT 20 OF SA9
PORT-12 TO FEED PIPE
PORT-15 FROM MR EQUILISING PIPE
PORT-5 TO B.C. EQUILISING PIPE
PORT-63 TO BRAKE CYLINDER
PORT-24 TO AUTO DRAIN VALVE

PORT SEQUENCE

Dt.	21.03.2005
D.	K.P.NIGAM
C.	M.C.Mahant
T.	