



भारत सरकार रेल मंत्रालय

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

डीजल—विद्युत एवं विद्युत रेल इंजनों (उच्च शक्ति डीजल—विद्युत एवं विद्युत रेल इंजनों सहित) ई.एम.यू./एम.ई.एम.यू एवं डी.एम.यू के प्रयोगार्थ द्विकक्षीय हीटलैस रीजनरेटिव प्रकार के एयर ड्रायर की विशिष्टि

Specification of Twin Tower Heatless Regenerative Type Air Dryers For Diesel–Electric And Electric Locomotives (Including High HP Diesel–Electric And Electric Locomotives), Electrical Multiple Unit (EMU) & Main Line Electrical Multiple Unit (MEMU) And Diesel-Electric Multiple Unit (DEMU)

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लखनऊ — 226 011
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List of Amendments:

S. No.	Amendment Date	Version	Details
1	March'21	06	Para 4.11 is modified for better clarity.
			Annexure-3, Group –A & Group B test modified, to incorporate acceptance criteria in compliance of MOM of the VC meeting on Specification/ STRs held on 29.08.2020. Group A test, Para 2 is modified to delete 2 parameters, pressurising, depressurizing time, as per the Firm`s comment.
			Annexure –8 Drawing is modified as per the Firm`s comment.

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1. Introduction

The presence of moisture in pneumatic system of locomotives causes malfunctioning of electro pneumatic and pneumatic devices. Although automatic drain valves have been provided in locomotives but the problem of moisture carry over alongwith compressed air could not be overcome. It has, therefore, been considered necessary to provide air dryers on locomotives so that the air supplied to the electro pneumatic and pneumatic equipment is clean and dry and does not cause any condensation of the moisture in the system.

2. Scope

This specification covers the design, inspection, testing, and installation of the air dryers for use on diesel-electric, electric locomotives (including high horsepower diesel-electric and electric locomotives), electrical multiple unit (EMU) & main line electrical multiple unit (MEMU) and diesel-electric multiple unit (DEMU). It shall be the responsibility of the supplier to work out a suitable design of the air dryer to meet the technical requirements indicated in this specification.

This specification supersedes the earlier specification no. MP-.0.01.00.06, Rev.05, March 2011.

Similar to the earlier specification no. MP-.0.01.00.06, Rev.05, March 2011, this specification may also be used in place of the following drawings/specifications for high horsepower locomotives:

- a) DLW GM P.L NO. 17450810 for WDG4/WDP4 EMD design locomotive application.
- b) CLW specification no. CLW/MS/3/041 dt. 18.10.96 for WAG9/WAP7/WAP5 Bombardier design locomotive application.

3. General Conditions

3.1 Design of Air dryers

Irrespective of specific technical details called for in this specification, the Air dryer offered by any vendor which is not approved by RDSO as on 1st June 2009 shall necessarily be as per the standard RDSO adopted drawings and specifications (henceforth called TOT documents), which can be obtained separately from RDSO.

However, the existing approved vendors can continue to supply air dryers as per their own models approved earlier by RDSO.

3.2 Service Conditions

The equipment shall be capable of working satisfactorily under the service conditions indicated below:

3.2.1 Altitude

Mean sea level to an altitude of 1000 meters above mean sea level.

3.2.2 Temperature

0° C to 55° C. The air temperature inside locomotive may reach as high as 70° C.

3.2.3 Operating Voltage

The electro pneumatic or electrical devices, shall be suitable for 72 volts DC on diesel locomotive and 110 volts DC for electric locomotives, EMU/MEMU and DEMU application. The voltage variation on diesel locomotive may be between 48 to 90 Volts and on electric locomotive, EMU/MEMU and DEMU application it may be between 85 to 130 Volts DC. Supplier will include protection against sudden variation in voltage, like surge, in the air dryer design itself.

3.2.4 Relative Humidity

Up to 100%.

3.2.5 Inlet Temperature

The temperature of compressed air at the inlet of air dryer may be as high as 60° C.

3.2.6 Details of Vibration Testing

Vibration testing shall be done in accordance with IEC-61373 (Category 1, Class A).

3.2.7 Other Conditions

The equipment shall be capable of operating efficiently inspite of dirt, dust, mist, torrential rain, heavy sand or stone storms and presence of oil vapours and radiant heat etc. to which the rolling stock is normally exposed in service.

4. Technical Requirements

4.1 Air dryer shall be of heatless twin tower regenerative type. It shall be light weight i.e. not exceeding 100 k.g. The system shall be suitable for continuous operation.

4.2 Operating Pressure

The air dryer shall be capable to work at nominal main reservoir pressure between 8-10 kg/cm² for both diesel and electric locomotives. At times pressure may go as high as 11 kg/cm².

The air dryer shall be capable to work at nominal main reservoir pressure between 6 - 8 kg/cm² for EMU/MEMU and DEMU application. At times, pressure may go as high as 8.5 kg/cm².

4.3 Air Dryer Capacity

4.3.1 **Diesel Locomotives:** On diesel locomotives compressor capacity varies from 2400 lit/minute at 400 rpm to 6000 lit/minute at 1000 rpm at 10 kg/cm². Normal duty cycle of compressor for air dryer design purpose, shall be taken as continuous air flow of 3000 lit./minute during train

working except for a period of 30 minutes or so at highest compressor capacity, during initial charging of the train.

- 4.3.2 **Electric Locomotives:** On electric locomotives compressor capacity varies from 1000 lit./minute to 2000 lit./minute at 10 kg/cm² for passenger locomotives and 2000 lit./minute to 3000 lit./minute for freight locomotives. Normal duty cycle of compressor for air dryer design purpose, shall be taken as continuous air flow of 1500 lit./minute for passenger locos & 2000 lit./minute for freight locos during train working except for a period of 30 minutes or so at highest compressor capacity, during initial charging of the train.

WAG9/WAP7/WAP5: Design air flow should be 3500 lit./minute.

- 4.3.3 **EMU Application:** On Electrical Multiple Unit (EMU) & Main Line Electrical Multiple Unit (MEMU), compressor capacity on driving units is presently 1075 litre / minute. Design air flow for air dryer shall be 1200 lit./minute to meet future upgradation of compressor capacity . However, it shall be capable to maintain dew point depression with airflow variation of 10%.

- 4.3.4 **DEMU Application:** On Diesel Electric Multiple Unit (DEMU), compressor capacity varies from 672 lit/minute to 2107 lit/minute at idle (350 rpm) and rated speed (960 rpm) of compressor. Normal duty cycle of compressor for air dryer design purpose, shall be taken as continuous air flow of 1500 lit./minute during train working except for a period of 20 minutes or so at highest compressor capacity during initial charging of the train.

4.4 Dew Point Depression

On the design air flow, the air dryer shall be capable to give a dew point depression of atleast 30°C for all conditions of ambient temperature as given in service conditions. In the worst case of air flow and ambient temperature, the air dryer shall be capable to give dew point depression of 15 ° C. The performance of air dryer in terms of dew point depression as given above, shall conform to the specification for atleast four years of service.

Dew Point Depression = A-B

A = Inlet dew point temperature

= Actual temperature at inlet to air dryer, at actual pressure, assuming 100% saturation of compressed air

B = Outlet dew point temperature

At outlet to air dryer, use dew point meter to measure dew point temperature at actual pressure

4.5 Purge Loss And Depressurisation Loss

Purge and depressurisation loss in terms of percentage of inlet air flow required for regeneration shall not be more than 20% at design capacity for diesel and electric locomotive application and 15% for EMU/MEMU and DEMU application. The supplier shall submit calculations for the same alongwith the offer. Assumptions made in the calculations shall be clearly mentioned.

4.6 Pressure Loss

The pressure drop across the air dryer shall not be more than 3% of inlet pressure. The supplier shall indicate the actual pressure drop for the unit offered.

4.7 Humidity Indicator

Air dryer shall be provided with humidity indicator which shall indicate the quality of outgoing air i.e. whether it is dry or wet. The colour code used for indication shall be preferably as under:

- .1 Dry air - blue colour
- .2 Wet air - white colour

4.8 Desiccant

The supplier shall indicate the quantity of desiccant per vessel to be filled in at a time and shall submit calculations for arriving at the quantity used.

The life of desiccant shall not be less than four years. Desiccant shall not disintegrate during use under operating conditions prevalent in the locomotives. Provision of compactor to maintain constant mechanical pressure on the desiccant packed in the vessels shall be provided so that the desiccant remains compact and tight. The type of compactor and its details shall be furnished in the offer.

The supplier shall also provide suitable arrangement for indicating the condition of desiccant. The details of the arrangement shall be furnished in the offer.

4.9 Change over from regenerative to dehydrating cycle and vice-versa shall be automatic. The cycle time of change over shall be mentioned in technical details. Air dryer shall be provided with memory feature.

4.10 The compressed air from the compressor may contain oil up to 20 ppm and water droplets for diesel & electric locomotive application. The supplier shall ensure satisfactory operation of the air dryer under such conditions and if it is considered necessary by the supplier, additional oil separator/filter may be included in the offer. The supplier shall indicate the type of media used for removal of oil from compressed air before the air enters the air dryer, along with the periodicity of its replacement.

4.11 The quality of air at outlet of air dryer shall generally conform to ISO 8573-1:2010 [4-3-4].

4.12 Manufacturer shall provide a certificate that noise level on test bench during air dryer operation does not violate Environment (Protection) Rules 1986. To reduce the level, noise inhibitor shall be used. If external muffler is provided then it shall be properly secured so that it will not fall on line.

4.13 The interconnecting piping for air dryer shall be supplied. The supplier shall indicate the piping used and submit the details of its specifications. The piping shall be non-corrosive, preferably of stainless steel.

4.14 Details of calibration for all measuring and testing equipment used in testing and manufacturing of air dryer shall be provided to RDSO.

4.15 Space Requirements & Interchangeability

4.15.1 Maximum envelope dimensions of air dryer including its mounting bracket and accessories are shown below:

Application		Drawing Details
Diesel Locomotive	ALCO & EMD (WDG4/WDP4)	SKDP 3566 Alt. 1 (Annexure 4)
Electric Locomotive	WAG7	SKEL 4556 (Annexure 5)
	WAP4	SKEL 4557 (Annexure 6)
	WAG9/WAP7/WAP5	CLW Drg. No. 01209-07.229.007 (Annexure 7)
EMU/MEMU and DEMU application	-	SKDP-3627 (Annexure 8)

These drawings are enclosed with this specification as Annexure- 4,5,6,7 & 8. Prototype fitment of air dryer as per drawing with mounting bracket shall be responsibility of supplier.

4.15.2 All suppliers shall ensure that the following items are strictly as per the TOT drawings so that these are interchangeable among all makes of Air dryers:

- .1 Humidity Indicator (complete unit)
- .2 Mounting arrangement
- .3 Electrical connector

5. Inspection, Testing and Approval

5.1 Inspection during developmental stage

5.1.1 During the developmental stage, for proper control & monitoring, RDSO shall be the Controlling Agency. The supplier shall submit its offer of equipment to RDSO along with all the details of equipment as per Annexure 1.

5.1.2.1 Prototype unit shall be subjected to endurance test for 50 hours duration.

5.1.2.2 Supplier shall conduct testing of prototype in accordance with Group A & Group B tests of Annexure 3 and submit results to RDSO. If found satisfactory, then prototype unit shall be tested in brake laboratory of RDSO as per the test scheme given in Annexure 2. The test scheme is a general guideline. Slight changes if required, may be there during actual testing of prototype. The firm shall supply necessary equipment and fittings as required during testing in Brake Lab.

5.1.2.3 Electronic equipment used in the system shall be tested in accordance with IEC-60571. These tests as per relevant clause of IEC-60571 shall be carried out for prototype only.

A certificate from recognised testing laboratory shall be considered satisfactory for this purpose. The tests required to be conducted are given below:

Srl.	Nature of Test	Details
1.	Visual Inspection	As per clause 10.2.1 of IEC 60571
2.	Performance Test	As per clause 10.2.2 of IEC 60571
3.	Reversal of Polarity	This is a design feature as per clause 5.2.6 of IEC 60571. The effectiveness of Reversal Polarity protection is tested over a period of not less than 1 minute within the specified voltage range. After this test the system shall be connected correctly and the performance checked. No degradation permitted.
4.	Effect of voltage variation	As per clause 3.1.1.1 of IEC 60571
5.	Weather proofness test	As per clause 10.2.4 & 10.2.5 of IEC 60571
6.	Water tightness test (with enclosure)	As per clause 10.2.12 of IEC 60571
7.	Temperature variation .1 Cooling test .2 Temperature rise test (with enclosure)	As per clause 10.2.3 & 2.1.2 of IEC 60571
8.	Insulation resistance test (with wiring harness)	As per clause 10.2.9.1 of IEC 60571
9.	High voltage test (Flash test)	This is done on the complete unit. The insulation between all terminals coupled tightened and earthed, shall withstand for one minute, 1000 V r.m.s, 50 Hz supply applied in such a manner as to avoid any ac voltage provided. During the test the maximum leakage current shall be measured which shall not exceed 0.005 A.
10.	Di-electric test (Applicable only if air dryer unit has more than one PCB)	If the unit has only one PCB then High voltage test & Di-electric test shall be common. If a number of PCBs exist, High voltage test as above and Di-electric test as per clause 10.2.9.2 of IEC 60571 shall be done.
11.	Surge test	As per clause 10.2.6 IEC 60571. The test circuit given in figure 4a of IEC 60571 shall be followed. The wave form A shall be followed.
12.	Vibration & shock tests (with enclosure)	As per clause 10.2.11 of IEC 60571

13.	Endurance test	The equipment shall be continuously worked for 125,000 cycles (approx. 90 days). These tests shall be carried out at the nominal operating voltage. The tests shall be acceptable if the equipment performs satisfactorily throughout the tests and also after the tests.
14.	RFI radiated	As per clause 10.2.8.2 of IEC 60571
15.	Inducted RF field conducted	As per clause 4.6 of IEC 61000 The signal is applied to DC power in lines. The frequency shall be varied progressively over the range 0.5-0.8 MHz and the voltage level is 3 v/m (level 2). During or after the test, no degradation of performance shall be allowed and the system shall work normally after the test.
16.	Electrical fast transient/ burst (capacitive coupling)	As per clause 4.4 of IEC 61000. The signal shall be applied to the data lines and voltage applied 0.25 Kv (level 1) [capacitive coupling]. Degradation of performance shall be allowed during the test but there shall not be permanent loss of function and the system shall work normally after the injected signals are removed.
17.	Electrical fast transient/ burst (direct injection)	As per clause 4.4 of IEC 61000. The signal shall be applied to DC power lines and voltage applied is 2 Kv (level 3). Direct Injection. Degradation of performance shall be allowed during the test but there shall not be permanent loss of function and the system shall work normally after the injected signals are removed.
18.	Power frequency magnetic field	As per clause 4.8 of IEC 61000 The signal shall be applied to the enclosure at the equipment. The magnetic field applied shall be 30 A/m(level 3). During or after the test no degradation of performance shall be allowed.
19.	Salt Mist Test	As per clause 10.2.10 of IEC 60571

5.1.2.4 Tests as per Group B of Annexure 3 shall be repeated by the supplier in case of any change in design affecting dew point depression or purge loss. Subsequently testing shall be done by RDSO/M.P duly following the procedure given in Para 5.1.2.2.

5.1.2.5 Fitment of air dryer shall be checked on the vehicle.

5.2 Regular Inspection

5.2.1 Regular inspection of the equipment shall be carried out by the purchaser or his nominee. The supplier shall provide, without any charges, material, equipment, tools and any other assistance, which the purchaser or his nominee may consider necessary for any test or examination. The supplier shall make available manufacturing drawings and material specifications of the components to the inspecting authority at the time of inspection.

5.2.2 Supplier shall offer air dryer for inspection after complete checking by them. The test results of every air dryer shall be submitted to the inspecting authority. Inspecting authority shall carry out all tests necessary to prove that the equipment fulfils the technical requirements, covered in this specification. However, Group A tests of Annexure 3 are mandatory.

5.2.3 Sample Size

Sample size for various tests is given below.

Lot size	For tests in Group A	
	Sample size	Number of rejection acceptable
Upto 25	3	0
25-50	5	0
50-75	8	0
75-100	10	0
More than 100	10% of the lot	0

Samples shall be picked up at random from the lot. If rejection number is more than the acceptable limit, inspection shall be stopped and entire lot shall be tested again by the firm. After checking the firm may re offer the lot for re inspection. Again sample checking shall be done by the inspecting authority. If second time also rejection is more than the acceptable limit, entire lot shall be rejected.

6. Performance Guarantee

The supplier shall give a guarantee of three years for the satisfactory working of the air dryer. Any equipment / component except consumable items which fails during guarantee period, shall be replaced free of cost by the supplier.

7. Technical Documents and Drawings

7.1 The supplier shall submit his offer and also all other information in English.

7.2 The supplier shall supply along with the offer two copies of layout drawings, operating instructions, maintenance instructions, spare parts catalogue, trouble shooting instructions and testing instructions of the complete assembly. The supplier shall also submit drawings for individual assembly and sub assembly. He shall also submit colour coded charts showing the operation of air dryer and also sectional views.

7.3 Offer shall include the requirement of spares /desiccant for a period of eight years (One Replacement kit for M-48 and 6 Replacement kits for M-12) for diesel and electric locomotive application and for a period of nine years (One Replacement kit for M-54 and 4 Replacement kits for M-18) for EMU/MEMU and DEMU application. The quotation for spares shall indicate the cost of individual components/assembly/subassemblies

- 7.4 The supplier shall indicate the maintenance and testing facilities required in the shed for proper upkeep of the equipment supplied by him and shall submit the list of such equipment with details including cost of individual equipment.
- 7.5 Along with the offer the supplier shall indicate indigenisation programme of air dryer if he is offering an imported air dryer. All the stages of indigenisation shall be mentioned along with time frame of these stages.
- 7.6 The supplier shall also provide a video or VCD of the working of air dryer for change of precoalescer filter, after filter and desiccant.
- 7.7 Installation of air dryer on locomotive shall be carried out either by supplier or by the purchaser not by any third party. Installation charges shall be quoted as an optional item.

8. After Sales Service

- 8.1 Supplier shall arrange to supply alongwith the equipment, maintenance manuals of the equipment one with every 5 sets. Manual shall contain information pertaining to detailed dimensional drawings indicating mounting arrangement layout, sub assemblies, principle of operation, maintenance schedules, trouble shooting, details of special tools if required, parts catalogue and testing procedure of the equipment being supplied. Updated position of modifications shall also be incorporated.
- 8.2 Adequate number of coloured wall charts showing pictorial view of components alongwith part nos. shall be given. The copies of Maintenance Manual and wall charts are meant for wider circulation for Railways and fresh copies shall be furnished as stipulated even if there are no changes in the manual and wall charts furnished against earlier contract.
- 8.3 The supplier shall impart training of working, operation and maintenance of the system free of charge to selected personal of Indian Railway, if Purchaser/RDSO desires so.
- 8.4 Supplier shall be able to provide after sales service through service centres/dealers located near the home shed/depot where air dryers are to be maintained.

9. Deviation

The supplier shall submit clause wise comments and shall indicate the deviation, if any, with the reasons thereof.

10. Revision Of Specification / Drawing

- 10.1 RDSO reserves right to change / revise any part of the specification.
- 10.2 In case any revision of the specification / drawing takes place within the period of approval, suitable time period shall be given to the firm depending upon the nature of the changes to implement the revised specification & the drawing of the product.

- 10.3 Subsequent to the revision of the specification, testing of the air dryer if required, shall be carried out on brake lab at RDSO and the testing charges in such cases are not to be levied for approved supplier, if the samples are submitted within the stipulated time. However, if samples fail and re-testing is carried out, the same shall be charged.

11. Preference to Make In India

The Government of India policy on ‘Make in India’ shall apply.

12. Vendor Changes In Approved Status

All the provisions contained RDSO’s ISO procedures laid down in Document No. QO-D-8.1-11, dated 01.07.2020 (Titled “Vendor-changes in approved status”) and subsequent version/amendment thereof, shall be binding and applicable on the successful vendor/vendors in the contract floated by Railways to maintain of products supplied to Railways.

13. Date Of Enforcement

The date of enforcement of the specification is with effect from 1/5/2021.

Annexure-1

Technical Details Of Compressed Air Dryer

Following details shall be furnished by the supplier along with the offer :

1. Type of air dryer.
2. Overall dimensions and mounting arrangement .
3. Material of vessels.
4. Maximum operating pressure.
5. Normal working pressure.
6. Maximum compressed air capacity which the air dryer can handle.
7. Purge loss and depressurization loss at various flow rates given below:

Application	Flow rate (liters/ min)						Inlet air temperature (degree centigrade)		
Diesel Loco	1000	1500	2000	3000	4000	6000	50	60	70
Electric locomotive	1000	1500	2000	3500	-	-	50	60	70
EMU/MEMU	1075	-	-	-	-	-	50	60	70
DEMU	700	1500	2100	-	-	-	50	60	70

8. Weight of the complete unit.
9. Desiccant and Source:
 - a) Type of desiccant with specification details.
 - b) Weight of desiccant per vessel.
 - c) Periodicity of replacement of desiccant.
 - d) Properties of desiccant :
 - Adsorption capacity with respect to inlet temperature and relative humidity
 - Particle size, density, crushing strength etc.
10. Pressure drop across inlet and outlet.
11. Drying, Regenerating periods.
12. Characteristic curves for dew point depression temperature with respect to ambient temperature in the temperature range of 5 to 55 degree centigrade with 100% relative humidity against air flow capacities indicated in item 7 above at maximum pressure of 10 kg/cm² for diesel and electric locomotive application and 8 kg/cm² for EMU/MEMU and DEMU application, with respect to time till the dew point is stabilised.
13. The details of routine tests conducted by the firm on every air dryer before sending to the purchaser.
14. A certificate from recognised testing laboratory covering testing of electronic equipment used in the system in accordance with IEC-60571. The results of tests required to be given are given in para 5.1.2.3.
15. Regenerative choke size
16. Pre Coalescer Filter
 - Type of media used for removal of oil
 - Efficiency

Annexure-2

Test Scheme to test air dryer in Brake Laboratory of RDSO

Test scheme for performance testing of compressed air dryer is being given below for testing in Brake Laboratory.

1. The test shall be conducted by fitting air dryer after main reservoir tank 1.
2. Compressor capacity and Main reservoir pressure

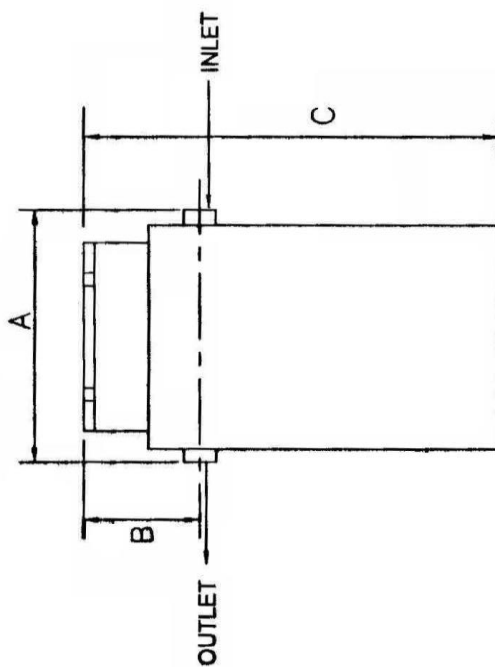
Application	Flow rate (litres/ min)				M.R Pressure
Diesel Loco	1700	3400	5100	6800	8-10 kg/cm ²
Electric locomotive	1700	2000	3400	-	8-10 kg/cm ²
EMU/MEMU/DEMU	1000	1700	2000	-	6.0 - 8.0 kg/cm ²

3. The following parameters shall be recorded for the above conditions:
 - a) Dew point temperature at the inlet of Air Dryer
 - b) Dew point temperature at the outlet of air dryer
 - c) Dew point depression curve with varying compressor capacity.
 - d) Drying period, regeneration period
 - e) Purge loss percentage with varying compressor capacity
 - f) Pressure drop across the unit.
 - g) Variation of relative humidity, pressure, dew point temperature shall be recorded at design capacity for continuous operation of air dryer for atleast 4 - 5 hours. On higher capacity testing time of air dryer shall be reduced.

Annexure-3

Group A Test			
Sr. No.	Parameters	Specified Value	Observation
1.	External and internal leakages in the unit, control piping and filters.	No Leakage	
2.	Drying and regenerative cycle time.	As per Mfg. Approved QAP	
3.	Pressure setting at the start of cycling operation of air dryer.	As per Mfg. Approved QAP	
4.	Pressure drop across the unit	Not more than 3% of Inlet Pressure	
5.	Cyclic operation of air dryer at varying voltage range given in para 3.2.3	As per Mfg. Approved QAP	

Group B Test			
Sr. No.	Parameters	Specified Value	Observation
1.	Dew point depression at compressor capacities given in para 4.3.	>30°C at Design Capacity >15°C at Maximum Capacity	
2.	Loss of air during purging and depressurisation.	20% at design capacity for diesel and electric locomotive application 15% for EMU/MEMU and DEMU application.	
3.	Any other tests considered necessary by the purchaser for the assemblies / sub assemblies shall be included in the tests during inspection.	-	



Dimensions			
A	B	C	D
381 mm (With Flanges)	119 mm	875 mm max.	487 mm max.

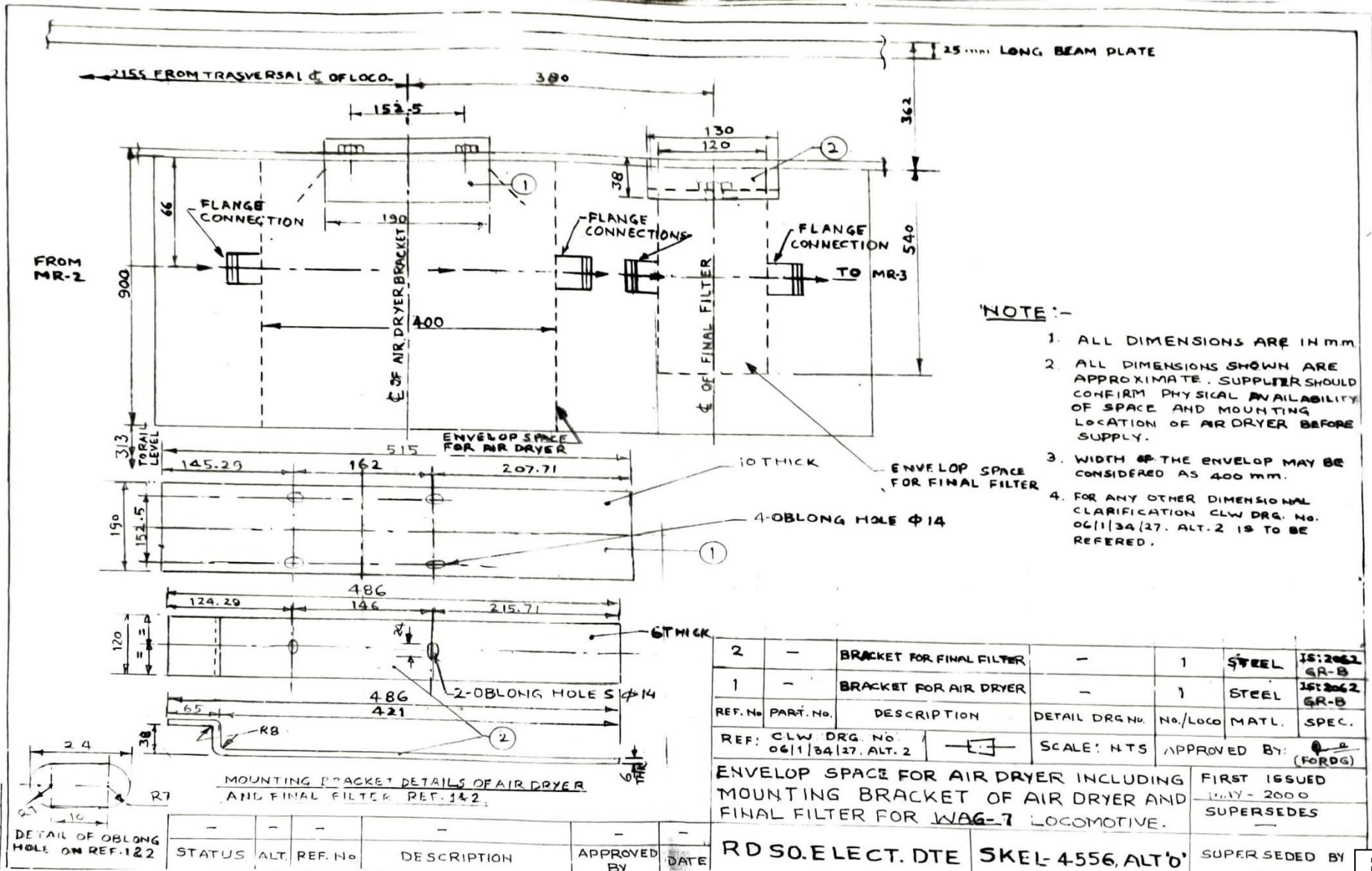
NOTE :

1. Mounting Bracket as per DLW Part no. 11247137.
2. Height of the bracket 'H' (Dim. 50 mm in DLW Part No. 11247137) should be such to maintain dimension 'B'.
3. Flange connections of Inlet & Outlet pipes should be 1-1/2" BSP.

<p>OUTLINE DIMENSION & MOUNTING DETAIL OF AIR DRYER FOR DIESEL LOCOMOTIVES</p>	<p>SCALE</p>	<p>आयतन</p>	<p>ORG. NO.</p>	<p>SK.DP. 3566</p>
	<p>प्रमाण आकार</p>	<p>निर्माण स्थान</p>	<p>निर्माण महीने</p>	<p>सुपरसेडेड बाय</p>

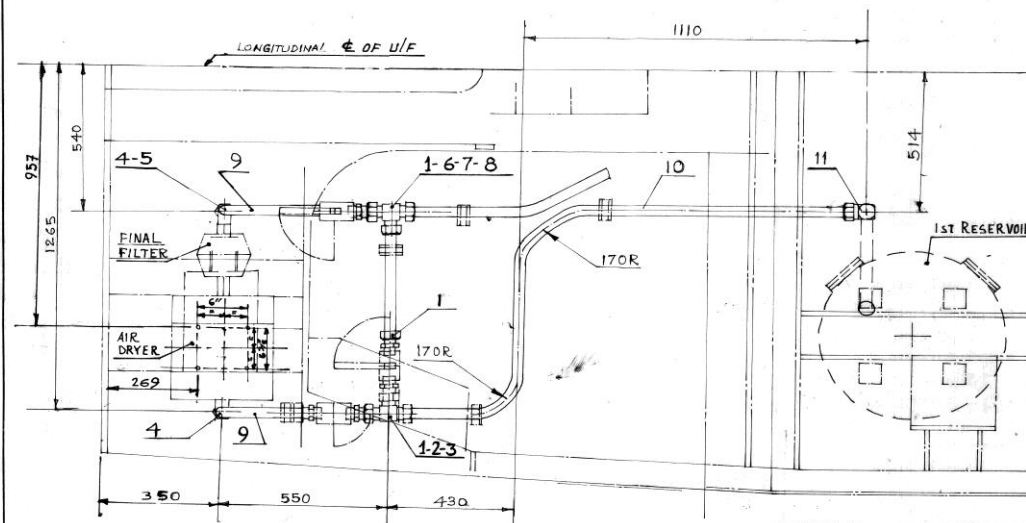
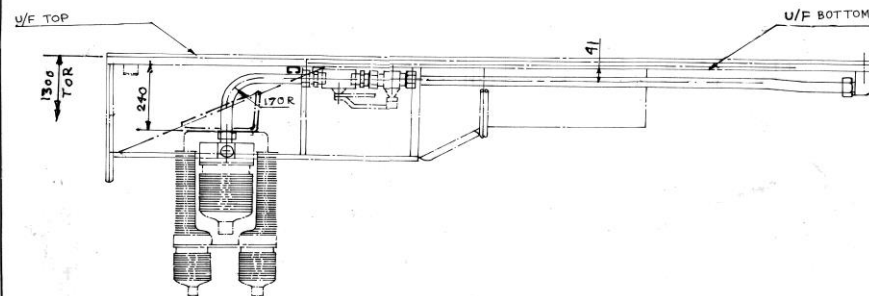
परिवर्तित ALT.	स्थानी की सं. NO. OF PLACES	संदर्भ नं. REF. NO.	विवरण DESCRIPTION	परिवर्तित आदेश ALT. NOTE NO.	हस्ताक्षर SIGN.	दिनांक DATE
1	-	-	Drawing revised and redrawn	L3-178	16	7/4

संख्या	१०८७
दिनांक	२३-५-२०००
स्थान	अपड.
आचार्य	APPD.
प्रमुख	
उपाध्यक्ष	
सचिव	
पर्याय	
विकास	
शिक्षण	
अन्य	



NOTE :-

1. LOCTITE 577 IS TO BE APPLIED TO EACH PIPE
FITTINGS BEFORE FITMENT TO EQUIPTS.



11	1209-18-366-02	1½" TUBE x 1½" MALE ELBOW	—	—	—
10	—	5 STL TUBE Ø381(1½") O/D x 18 GA.	S STL	ASTM A 269 GR. 304 F	—
9	—	5 STL TUBE Ø381(1½") O/D x 18 GA.	S STL	A 375-60 Ø3.18"	—
8	—	D&M ISOLATING COCK 1¼"	—	—	—
7	—	D&M LATCHED ISOLATING COCK 1¼" VENTED —	—	—	—
6	1209-18-366-08	1½" UNION TEE SPECIAL	—	—	—
5	1209-07-329-02	FLANGE FEMALE	—	—	—
4	1209-18-366-02	1½" TUBE x 1¼" MALE ELBOW	—	—	—
3	1209-18-366-03	1½" UNION TEE SPECIAL	—	—	—
12	—	D&M ISOLATING COCK 1¼"	—	—	—
1	1209-18-366-02	1½" TUBE x 1¼" BSP MALE CONNEG.	—	—	—
		PIPING LAY OUT BETWEEN FIRST RESERVOIR & AIR DRYER	—	—	—
श्रीलंका REF NO.	अन्य प्रमाण एकम PART DRG. NO.	वर्णन DESCRIPTION	धामा / टैक्स NO. / LOCO	समीक्षित माल. SPECIN	प्रतिपाद RE. BY WT. LOCH WPK. G.
अनुमोदित डिजाइन BY CHKD DATE APPROV. DATE REVISIONS R/S (REV.) REVISED X REF.D DATE	स्वीकार 12-7-59	असेम्बली संदर्भ REF. ASSY. DRG. NO. ABB'S DRG. NO. 1 B 071-00058		अभिज्ञान एवं विकास केन्द्र D & D CENTRE चित्रारंजन लॉकोमोटिव कारखाना CHITTARANJAN LOCOMOTIVE WORKS	
T112 T12	निर्मित DATE	प्राधिकृत आयुक्त DATE		लोकोमोटिव C & D NO. प्रयोग में USED FOR LOCOS	
55 50	मापन SCALE	प्रमाण NBSI.		1ST ANGLE PROJECTION आरेखण संख्या DRAWING NO. 1209-07-229-007	

D PK PAUL
C JP CHUBEY
APPD
DIR/MP-BK
Dt 20-3-01

