



सत्यमेव जयते
भारत सरकार
रेल मंत्रालय

GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
अनुसंधान अभिकल्प एवं मानक संगठन
RESEARCH DESIGNS AND STANDARDS ORGANISATION

सभी प्रकार के आर० एम० पी० यू० के निर्माण करने के लिये
शिड्यूल आफ टेक्नीकल रिक्वायरमेंट (एस०टी०आर०)
SCHEDULE OF TECHNICAL REQUIREMENTS (STR) FOR MANUFACTURE
OF ALL TYPE OF ROOF MOUNTED AC PACKAGE UNIT

RDSO/PE/STR/AC/0008-2003 (Rev.5)

S.N	Date of amendment	Revision	Reason
1.	March 2012	2	-
2.	March 2018	3	<ul style="list-style-type: none"> 1. Para A (7 & 8) added, Last Para added in Note (1). Additional M&P included enhancing the quality of RMPU & safe working environment. 2. Para C (5, 6, 7, 8, 9 & Note added). (Up gradation of test lab as per international Standards) 3. Para G (4) added. (Copper fins and copper tube with tinning shall be used in LHB RMPU) 4. "Note" added at the end of Para (G). 5. Para H (1) amended. H (2&3) added. Clause more clarified. 6. Para H8(Note 2) added. To improve the after sales & service. 7. Para I (2) added. Refrigeration engineer is also allowed. 8. Para J (3) amended. Para clarified etc.
3.	March 2020	4	<ul style="list-style-type: none"> 1. Para (A) split into A.1 and A.2, adding design & development facilities and 5 years' validity of MOU. 2. Para (C) amended, CCA clearing after setting up of psychometric lab and amendment in WBT 13°C to 18°C at 30°C DBT, RH is revised as 15 to 42%, Heat pump 2 to 30°C. 3. Para (E) amended, adding covered/un-covered factory premises and proper loading/un-loading facilities 4. Para (G) amended – Some other facilities added. 5. Para (H) amended 6. Para (I & J) re-arranged/amended
4	April-2022	5	<ul style="list-style-type: none"> 1. Automobile word & minimum qualifying quantity of Air conditioner for automobile application added in Para H(b) to broaden the qualifying criteria.

अनुमोदित
APPROVED

प्रधान कार्यकारी निदेशक / पी एस एण्ड ई एम यू

PED/PS & EMU

Prepared by	Checked by
SSE/TL-AC	JDSE/TL-AC

**SCHEDULE OF TECHNICAL REQUIREMENTS (STR)
FOR MANUFACTURE OF ALL TYPE OF
ROOF MOUNTED AC PACKAGE UNIT**

INTRODUCTION

Roof Mounted AC package unit & control panel provided on passenger carrying rolling stock is a critical item, it is therefore necessary that the firms intended to manufacture & supply these items should have all the infrastructural & testing facilities necessary for their production & testing along with qualified personnel having sufficient experience in designing, manufacturing & testing in similar field. This STR is applicable for all types of RMPUs. Indigenous development of RMPU sources for rolling stock application shall be done as per this STR.

However, manufacturers complying to the following eligibility criteria shall also be considered:

“The manufacturers who have capability to design and manufacture RMPU of similar capacity for rolling stock application and already supplied at least 500 RMPU of similar or higher capacity to International Railways/Metro system in India or abroad for rolling stock application, in any two of last five years and at least 30% of above quantity should be working satisfactory for one year, need not follow RDSO’s STR stipulation of in-house manufacture of various sub components/assemblies required for RMPU manufacturing. However, such firm shall have requisite test facilities, service network and qualified personnel. Firm should submit the necessary infrastructure details and quality system procedure of sub vendors to whom these items are proposed to be out sourced. RDSO may audit such facilities”.

The indigenous firms seeking registration/approval for manufacture and supply of Roof Mounted AC Package Unit as per RDSO specification should meet the technical requirements as under:

A.1 DESIGN & DEVELOPMENT FACILITIES

Necessary software/calculation module for system design simulations required for designing/selection of various equipment for air-conditioning system such as heat load calculation, compressor, heat exchanger’s selection and air requirement calculations etc. under varying operational conditions.

A.2 MACHINARIES & PLANTS APPROPRIATE FOR PROCESSING STAINLESS STEEL USED DURING MANUFACTURING

1. CNC Shearing/cutting, bending & punching Machines etc.
2. Hydraulic/Pneumatic/Power press
3. Drill Machine
4. Grinding machine and portable grinder
5. Jigs & Fixture suitable for welding, leveling and mounting of RMPU.

Prepared by	Checked by
SSE/TL-AC	JDSE/TL-AC

6. TIG, MIG & spot welding machine
7. Hydraulic/electric/pneumatic riveting gun
8. Safety equipment such as helmet, hand gloves & eye protection spectacles etc.

Note:

- 1) In case, the above facilities are utilized from their sister concern, the mutual agreement (MOU) on non-judicial stamped paper duly notarized and valid for 5 years shall be submitted to RDSO at the time of submission of application form for registration. The agreement shall include the details of their terms & conditions. It shall be the responsibility of the firm to renew the validity of MOU one month prior to expiry date and submit renewed MOU timely to RDSO.
- 2) Portable grinder, drill machine and spot welding machine should also be available with principle vendor for day to day work.

B. TOOL AND PLANTS

1. Two stage vacuum pump >1000 lpm with self-vacuum level <50 microns with vacuum gauge.
2. Leak testing tank
3. Dynamic balancing machine ≤ 2 gm.
4. Air compressor with reservoir
5. Refrigerant charging machine with accuracy of 0.5% of refrigerant charge.
6. Oxy-Acetylene or Oxy-LPG brazing setup with liquid flux.
7. Tools and dies suitable for stainless steel processing
8. Measuring tapes
9. Vernier caliper
10. Standard measuring gauges
11. Screw gauge
12. Hand lamp
13. Other hand tools like spanner, pipe bending machine etc.

C. TESTING FACILITIES

1. Rain test arrangement as per RMPU's specification
2. DG set of adequate capacity as stand by power supply
3. Power supply arrangement/device for obtaining variable voltage ($415 \pm 10\%$) and variable frequency (50 Hz $\pm 3\%$)
4. Three phase PWM supply (Minimum 15 kW).
5. Capacity test arrangement :

Prepared by	Checked by
SSE/TL-AC	JDSE/TL-AC

Fully automatic psychometric laboratory as per ASHRAE/international standards capable of maintaining the cold room/hot room conditions as under:

- In cold room (For both Refrigerant pump and Heat Pump) :
DBT: 15°C-30°C
WBT 10°C to 13°C at 15°C DBT

WBT 18°C to 20°C at 30°C DBT
- Hot room :
 - (i) For normal cooling test & Heating test using Electric Heaters

DBT 30°C, WBT 17 to 21°C
RH 25 to 45%

DBT 35°C, WBT 20 to 25°C
RH 25 to 45%

DBT 40°C, WBT 20 to 28°C
RH 15 to 42%

DBT 40°C to 60°C
RH below 35%.
 - (ii) For Heat Pump

DBT 2 °C to 30 °C.

The arrangement shall be in such a way that the uniform temperature in both the rooms is maintained.

The test setup should have the integrated software based recording facilities for the following:

- i) Suction & discharge pressures i.e. LP & HP.
- ii) Dry bulb/wet bulb temperature at return, fresh air & supply air path in cold & condenser inlet/outlet in hot room.
- iii) Static head with the arrangement to vary & fix from 10 mm WG to 25 mm WG.
- iv) Voltage, current, power factor and power consumption of the RMPU.

Prepared by	Checked by
SSE/TL-AC	JDSE/TL-AC

- v) Manual measurement of air flow over condenser coil (inlet) in hot room by duly calibrated anemometer.
 - vi) The temperature measurement (DB & WB) at the condenser outlet with the help of duly NABL accredited /Govt. recognized lab calibrated mercury thermometer is allowed and accepted.
6. The test room must be equipped with electronic data logger with minimum
 - 30 channels and sensors for DB & WB measurement
 - 8 channels and sensors/transducers for pressure measurement 0 to 40 bar @ 1% accuracy.
 - 8 voltage, current and PF channels along with associated CTs.
 - Digital energy recording system
 - Kilo-watts meter
 7. PC with psychometric calculations and report making software.
 8. One trained operator-engineer as an own employee.
 9. Raised platform for keeping RMPU for capacity test.

NOTE:

- 1) There should be no need to provide additional heaters, humidifier/dehumidifier or other equipment/apparatus inside the test room.
- 2) The wall, roof & floor of the test room should be thermally insulated adequately.

D. MEASURING AND TESTING INSTRUMENTS

1. Testing jig for checking proper functioning of RMPU in conjunction with microprocessor controller and verifying logics & activation of various safety cutouts.
2. Dry and wet bulb thermometer of suitable range - 16 Nos.
3. Pressure gauges - 5 nos.
4. Micrometer
5. Watt meter
6. Power factor meter
7. Volt meter
8. Amp. Meter
9. Tongue tester
10. Frequency meter
11. Mano-meter
12. Anemometer
13. 1000/500 V dc megger/Insulation tester

Prepared by	Checked by
SSE/TL-AC	JDSE/TL-AC

14. HV tester
15. Electronic leak detector

Note:

1. All testing and measuring instruments shall be duly NABL accredited/ Govt. recognized lab calibrated.
2. One set of Instrument shall be available as standby, so that the same may be available in the plant in case of need.

E. FACTORY PRIMISES AND TRANSPORT FACILITIES

1. Adequately sized covered & un-covered factory premise having good road connectivity.
2. Mobile trolley and hoist
3. Fork lifter/Crane
4. Proper loading & un-loading facilities

F. TEST BENCH

The manufacturer shall have test bench atleast for the following items to check the suitability of the bought out material to avoid induction of defective material in to regular production of the RMPU.

- a) Motors
- b) Heater
- c) HP/LP switches
- d) Control pressure switches
- e) OHP
- f) Expansion valve

Note: Tests on above shall be as per firm's own QAP and firm shall submit the QAP for the tests of equipment mentioned above.

G. HEAT EXCHANGER MANUFACTURING FACILITY

1. The firm should have full-fledged automated coil manufacturing and testing facilities and should be under the possession of ISO 9001-2015 certification. The manufacturing & testing facilities shall generally include the following plants and machineries:

- (i) Automatic Fin presses
- (ii) Tube expanders
- (iii) Hairpin benders
- (iv) Hot air oven for contamination removal
- (v) Automatic brazing setup

Prepared by	Checked by
SSE/TL-AC	JDSE/TL-AC

- (vi) Leak testing facility i.e. water leak testing with nitrogen @ 650 psi.
 - (vii) Coating thickness meter
 - (viii) Salt fog testing arrangement
 - (ix) Tinning setup
2. The machine operators should have minimum one year experience of operating the respective machine.
 3. Firm should have at least 2 certified personnel in the field of brazing of copper to copper, copper to brass and copper to steel refrigerant pipes and welding on stainless steel, having the experience not less than 03 years.
 4. Brazer to be certified as per EN 13585 and welders to be certified as per EN9606-1 for stainless steel welding and EN 9606-2 for aluminium welding from NABL accredited 3rd party.
 5. The firm shall keep record of weightment of heat exchanger & count of FPI (fins per inch) as per their sample plan.
 6. Work instruction/procedure for important activities such as treatment of welded/brazed joint and tinning process with necessary gauges & control for accurate coating thickness should be prominently displayed at work place.
 7. Complete stage inspection record shall be made available for scrutiny by the firm at the time of assessment and inspection.
 8. A separate Quality Assurance Plan for coil manufacturing shall be available with the firm and shall cover the following:
 - a) Organizational chart clearly bringing out the quality control set up.
 - b) Qualification log sheets of the personnel manning the quality control set up.
 - c) Process flow chart indicating the process of manufacture of coil.

Note: In case heat exchangers manufacturing is out sourced, the sub vendor (supplier of coil) should have the facilities mentioned above. RDSO shall approve sub-vendor after getting satisfied about conformity of compliances of infrastructure & testing facilities as above. Firm shall enter into MOU with coil manufacturer for at least 5 years. MOU shall be made on non-judicial stamp paper duly signed by both parties on each page indicating the validity and other terms & Conditions and should be notarized. Salt fog testing facilities may be availed from any NABL accredited/Govt. recognized Laboratory. The RMPU

Prepared by	Checked by
SSE/TL-AC	JDSE/TL-AC

manufacturer can also enter into MOU with more than one heat exchanger manufacturer. Under this circumstance, the MOU with all manufacturers shall be submitted and the capacity test of RMPU shall be repeated for each make. It shall be the firm's responsibility to advise RDSO in advance about the make of heat exchanger they intend to use.

H. PERSONNELS & THEIR EXPERIENCE

- 1) Firms having core competency in the field of designing and manufacturing of air-conditioning/refrigeration system shall only be considered for registration. The core competency in the field of designing and manufacturing of air-conditioning/refrigeration system will be decided based on the following:
 - a) The experience of the firm in designing, manufacturing & supply of air-conditioning/refrigeration system. It should not be less than 3 years.
 - b) In last 3 years, the manufacturer should have supplied 100 units of not less than 1.5 TR capacity of RMPU/HVAC/refrigeration/cab AC to Railways/metro for rolling stock application or **5000 units of similar or higher capacity for Automobile** system. Firm should produce documentary evidence for the supplied quantity indicating PO No., Qty., Value, date of delivery and name of the firm to who supplied etc.
- 2) Firm should have more than two qualified engineers in electrical & mechanical/refrigeration with experience of minimum two years in the field of design, manufacturing and testing in respective fields. Firm shall submit the complete details of qualification and experience of personnel involved in the field of design, manufacturing and testing of HVAC units.
- 3) Firm should also have well trained manpower conversant with air-conditioning & refrigeration system. In this regard, firm shall submit details of manpower along with their qualification and experience of personnel.
- 4) Firm should also have 24X7 computerized customer care centers for logging complaints of their product and adequate after sales service network all over India. It shall include details of complaints number, date & time of complaints login and man deputed to attend complaint along with their mobile number etc.

4.1 Firm should have their own setup for attending failure within warranty as well as after warranty instead of awarding contract to their sub-

Prepared by	Checked by
SSE/TL-AC	JDSE/TL-AC

vendor. Sub-vendor for AMC/CMC of AMC/CMC holder is not acceptable. Firm should submit the details of the employee involved for various stages of maintenance throughout India.

I. Certifications:

- 1) Firm should have process certification by 3rd party (Only accredited lab) for brazing, welding, tinning and soldering as per EN 13134 for welding, EN 15085-2 for tinning & soldering.
- 2) The firm should have ISO 9001-2015 certification for manufacture & design of HVAC/refrigeration units.

J. Documents to be submitted along with application form for registration:

- 1) The QAP (separate QAP for RMPU and heat exchangers) covering the following aspects:
 - a) Organizational Chart, clearly indicating the Quality Control Set-up.
 - b) Qualification of key personnel and the officials deployed in Quality Control Cell.
 - c) Process Flow Chart indicating process of manufacture for an individual product or for a family of products if the process is same.
 - d) Quality Assurance System – Inspection & Testing Plan. This shall cover the following:
 - Incoming material
 - Process control
 - Product control
 - System control
 - List of sub vendors and inspection plan indicating the following:
 - (i) Name of the item for which sub-vendor is approved
 - (ii) Inspection criteria of sub-vendor
 - (iii) Sub-vendor has ISO:9001-2015 certification
 - (iv) QAP of sub-vendor is approved by the primary vendor
 - (v) Submission of Quality manual of sub-vendor to the primary vendor
 - (vi) Sub-vendor has submitted the quality manual to the primary vendor
 - (vii) Sub-vendor has all the requisite infrastructure of manufacturing and testing facilities, preferably under one roof.
 - (viii) Periodical inspection schedule for sub-vendor is being followed strictly by the primary vendor.

Prepared by	Checked by
SSE/TL-AC	JDSE/TL-AC

- e) Stage inspection detailing inspection procedure, inspection parameters, method of testing/test procedure including sample sizes for destructive and non-destructive testing etc.

The generalized format for covering the information under (d & e) should be as below:

Subject/ Product/ Process	Sample Size & its Frequency of inspection	Parameter s for inspection	Mode of inspection/ equipment used	Acceptance limits/ Criteria /specified Value	Rejection details Re- processed/ Scraped
---------------------------------	--	----------------------------------	---	---	--

- f) Calibration scheme and status of calibration of test equipment.
- g) QAP covering all the information as asked above under item 'a' to 'f' must be given in the form of single document indicating name of the firm and page no. 'x' of 'y' on each page. Each page should be signed by QC in-charge. The approved QAP must be a controlled document and a quality record of ISO 9001-2015 quality control system of the vendor. A certificate to this effect shall be provided along with the QAP by the vendor.
2. Softcopy of complete test results, QAP, BOM, clause by clause comment on specification, STR compliance etc. in searchable pdf format.

Note:- 1) Firm shall keep all the records related to internal quality control, stage/process inspection and final testing of the product/individual equipment/component for easy traceability of a particular job. Traceability diagram to be submitted by the firm.

K. R & D FACILITIES

- 1) The firm should have R & D facilities such as capability of calculation related with air-conditioning system, psychometric chart, books, catalogues and equipment selection capability etc. to investigate into the various types of failures and evolve necessary remedial measures to avoid failures in future.
- 2) The R&D department should be separate division/department headed by an electrical/mechanical/refrigeration engineer having at least 5 years experience in design and development of HVAC/refrigeration system.

Prepared by	Checked by
SSE/TL-AC	JDSE/TL-AC

DISTRIBUTION

CHIEF ELECTRICAL SERVICE ENGINEER/ CEDE:	
1.	Northern Railway, Baroda House, New Delhi – 110 001.
2	Central Railway, II Floor, Parcel office, CST Mumbai – 400 001.
3	Eastern Railway, Fairlie Place, Kolkata – 700 001.
4	South Eastern Railway, Garden Reach, Kolkata – 700 043
5	Southern Railway, Park Town, Chennai – 600 003.
6	Western Railway, Church gate, Mumbai – 400 020.
7	South Central Railway, Rail Nilayam, Secunderabad – 500 371.
8	East Central Railway, Dighi Distt- Vaishali, Hajipur Bihar- 844 101.
9	North Central Railway, North Central Railway, Subedarganj, Allahabad- 211033
10	South Western Railway, New Zonal Head Quarter's Office, Ist floor, West Block, Gadag Road, Hubli-580020 (Karnatka)
11	South East Central Railway, Bilaspur.495004
12	North East Frontier Railway, Maligaon, Guwahati - 781001
13	North Eastern Railway, Gorakhpur – 273001
14	North Western Railway, Jaipur – 302006
15	West Central Railway, Jabalpur - 482001
16	East Coast Railway, Bhuvneshwar, Orissa – 751016
17	Konkan Railway, Belapur Bhavan, Sector-11, Belapur, Mumbai - 400614
18	Metro Railway, 33 /1 J.L. Nehru road, Kolkata- 700071
19	Integral coach factory, Perambur, Chennai - 600038
20	Rail Coach Factory, Kapurthala (Punjab) – 144 602
21	Modern Coach Factory, Lal Ganj, Rae Barelie (U.P.) - 229120
CHIEF WORKS MANAGER:	
1	Matunga Workshop, Central Railway, Mumbai 400 019.
2	Liluah Workshop, Eastern Railway, Howrah
3	C&W Workshop , Northern Railway, Alambagh, Lucknow-226 05
4	C & W Workshop, N. Rly., Jagdhari – 135 002
5	Mechanical Workshop, NER, Gorakhpur – 273 012
6	Carriage Workshop, Perambur, Ayanavaram, Chennai – 600023.
7	SCR, Lallagudda Workshop, Lallaguda, Secunderabad - 500017
8	Carriage Workshop, Western Railway, Lower Parel, Mumbai-400013
9	CRWS, W. C. Railway, Nishatpura, Bhopal-462010
10	Carriage Workshop, NW Rly, Ajmer - 305001
11	Carriage Repair Workshop, Gadag Road, SWR, Hubli – 580 020
12	Carriage Workshop, Mysore Vishwanath.
13	Carriage Workshop, SE Rly., Kharagpur - 721301
14	New Bongaigaon, Railway Workshop, Dangtal, Distt. Bongaigaon, Assam-783380
15	Carriage and Wagon Workshop, SC Rly., Jhansi – 248003
16	Carriage and Wagon Workshop, WC Rly., Kota - 324002

Prepared by	Checked by
SSE/TL-AC	JDSE/TL-AC

17	Carriage and Wagon Workshop, Eastern Rly., Liluha - 711204
18	Carriage and Wagon Workshop, W. Rly., Pratap Nagar, Vadodara - 390004
19	Carriage and Wagon Workshop, N Rly., Amritsar - 143001
20	Central Workshop, Goldenrock, S. Rly., Trichi - 620004
OTHERS:	
1	Director, IRIEEN, Nasik Road (Maharashtra). - 422101
2	Senior Professor (Elect.), Railway Staff College, Lalbaug, Vadodara. - 390004
3	Director, IRCAMTECH, Maharajpur, Gwalior – 474 020.

FINAL DRAFT

Prepared by	Checked by
SSE/TL-AC	JDSE/TL-AC