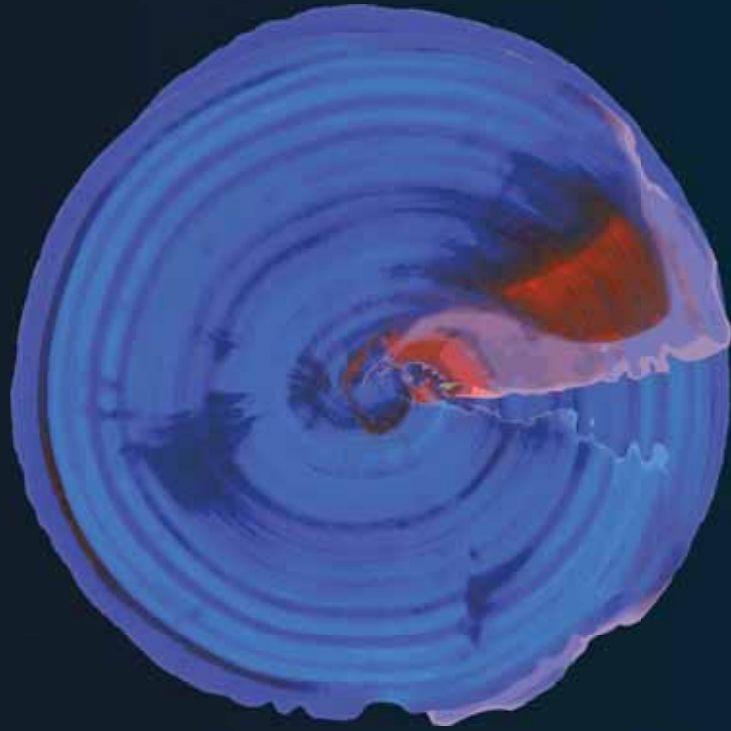


KOLDFORM™

TRANSPORT AIR CONDITIONERS



PRAG
INNOVATION AT WORK



योग: कर्मसु कौशलम्

"Excellence at work is 'Yog' - the union of one's consciousness with the supreme."

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ABOUT US

Prag Group of Industries, headquartered in Lucknow, is a leading designer and manufacturer of a range of advanced engineering products and equipment for railway and industrial applications.

Our product range includes:

- Railway Bogie Suspension
- Longitudinal Energy Management Systems
- Bogie Mounted Air Brake Systems
- Filters and Filtration Systems
- Heating, Ventilation, and Air Conditioning (HVAC) Systems
- Heatless Regenerative Air Dryers
- Plate- Type Heat Exchangers
- Water Purifiers & Coolers
- Auxiliary Power Units
- Switchboard Cabinets and Power / Control Panels
- Virtual Reality Driver Training Simulators

Prag's foray in engineering thermodynamics started in 2004 with the introduction of the first completely indigenous plate-heat-exchanger for diesel-electric locomotives.

Subsequently, with heat exchanger design and thermal management as a core strength, Prag, over the years, introduced several technological breakthroughs in the engineering thermodynamics segment including thermal insulation for locomotive compressor and exhaust systems, onboard water coolers, and driver cab and passenger coach air conditioning systems.





In 2016, Prag introduced India's first-ever split-type air-conditioning system for onboard railway applications. The design, which allowed for retrofitment in existing diesel-electric locomotives, was duly approved by Research, Designs, and Standards Organization of Indian Railways.

Prag was also the first to introduce onboard water purifiers-cum-coolers in the Indian Railways, with several units running successfully today providing clean, potable, cold drinking water to passengers.

Some of our recent innovations include the first introduction of Cab Air Conditioning in Mumbai Suburban EMUs and Saloon Air-Conditioning for the prestigious Vande Bharat Express – India's first semi-high-speed trainset.

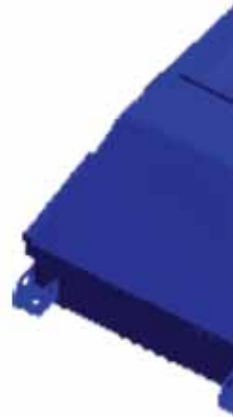


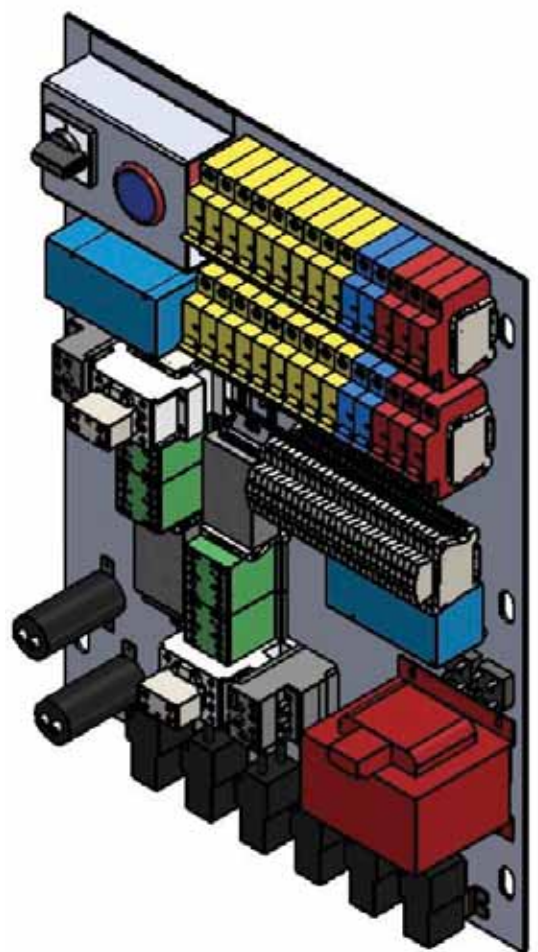
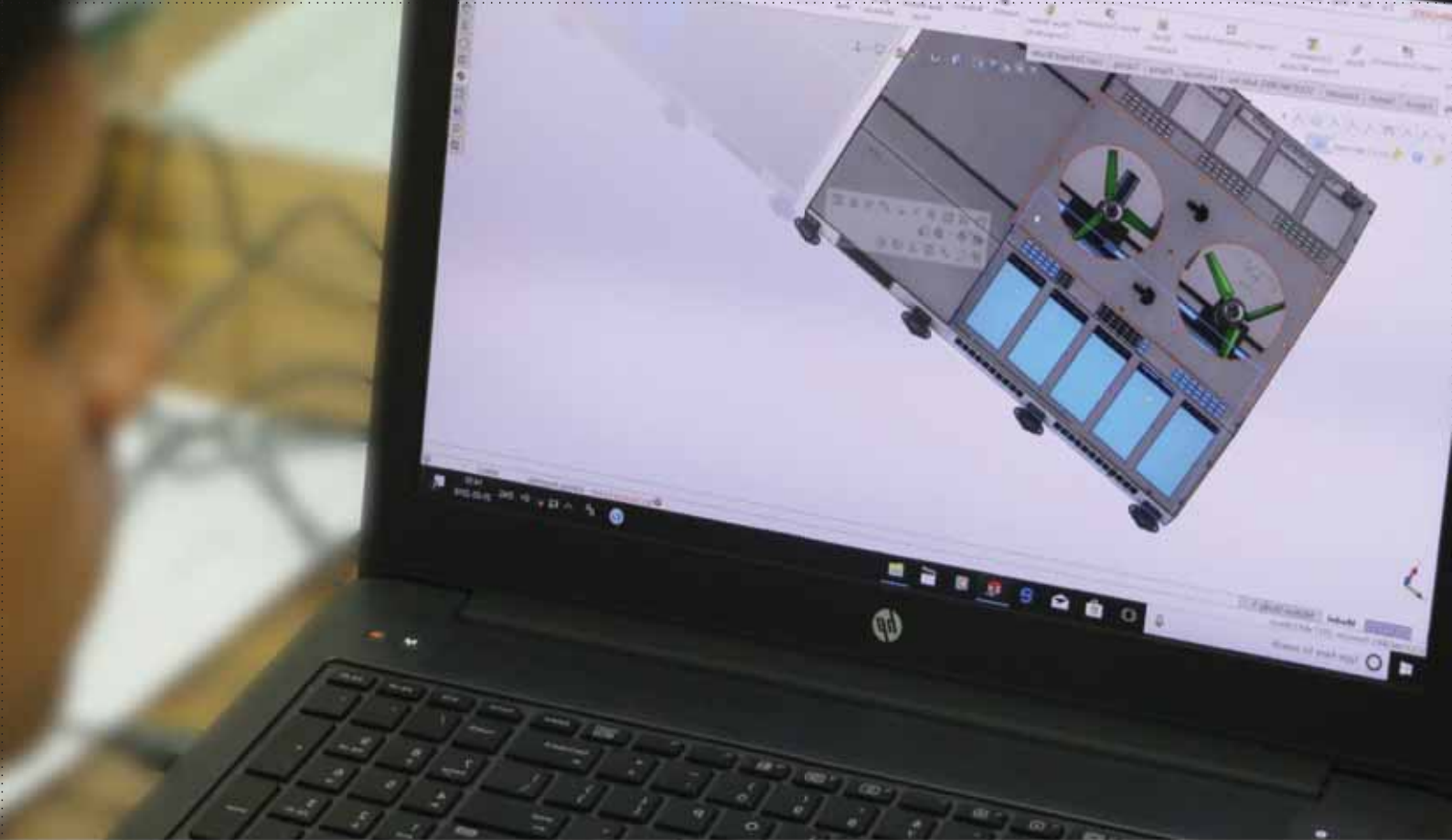
DESIGN & ENGINEERING

At Prag, development of any new product begins with extensive analysis and simulations on 3D models including FEA, Fatigue, Impact, and CFD analysis on linear as well as non-linear materials. Our in-house Design Center utilizes Siemens NX and Solidworks for 3D Modeling, CAM and Electrical Schematic Generation along with specialized Coil Design software for design of bespoke heat exchangers. Our in-house 3D printer enables us to generate 3D prints of new designs for analysis.

For example, when designing a new inlet air filter, the required filtering efficiencies and pressure drops are factored into the design using CFD analysis at the product conceptualization stage itself. This technology enables us to generate the most ideal designs that have undergone extensive virtual testing well before actual prototyping and physical product development. This helps us not only design products with the most optimal performance, but also drastically cuts down the time required for new product development.

The HVAC design process begins with a detailed study of the operating environment, car volume, solar loading, peak passenger traffic, and airflow within the passenger compartment. By leveraging our design team's years of experience in engineering thermodynamics and the proficiency of cutting-edge software, we are able to consistently introduce new and improved HVAC-R products that reliably meet and exceed customer expectations.





MANUFACTURING FACILITIES

Prag's state-of-the-art manufacturing facilities give us an edge when it comes to providing our customers with world-class engineering products. The Koldform™ product line is assembled in a world-class vertically integrated manufacturing facility located in Lucknow, India.

Our assembly lines are designed to ensure logical arrangement of equipment, streamlined material flow and high-speed manufacturing, while ensuring meticulous compliance of each and every operating procedure and complete product traceability.





QUALITY CONTROL

Quality is built into the manufacturing process starting from the raw material inspection stage right up to final product assembly. Standard quality checks are laid down at every step to ensure the highest level of quality and reliability. All of our extensive in-house testing facilities are ISO 9001:2008 certified and are equipped with some of the latest test equipment such as:

- Six-Axis Dynamic Endurance Test Equipment with Moog Controls
- Spectrometers for Metal Properties Testing
- Computerized Universal Testing Machines
- Vibration Testing Machine
- Fire Retardancy & High Voltage Test Labs
- Computerized Functional and Leakage Test Equipment
- Air Filter Test Rigs designed and calibrated by IIT, Delhi
- Environmental, Ozone Test & Low-Temperature Testing
- Rain Test Arrangement for Roof Mounted AC Package Units
- Fully Automatic Psychometric Lab with 90-Channel Data Logger
- Switchboard Cabinet Test Rig with load bank up to 200A
- Temperature scanner with 32 Channel data logger facility



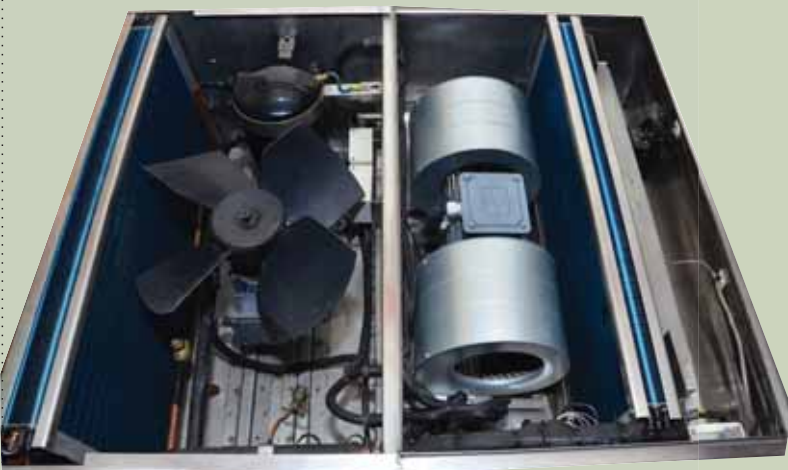


PRODUCTS

LOCOMOTIVE DRIVER CAB AC

The Koldform™ LC-702 Roof-Mounted Air Conditioning System [RMAC] is a self-contained unit of monoblock design to be inserted into a fabricated aperture directly in the rail coach roof area. The system comprises of a single-stage R-407C vapor compression refrigeration system providing cooling capacity of 7.02 kW at ambient temperature of 35°C [Dry Bulb], maintaining 23°C to 25°C temperature inside the cab.

TECHNICAL DETAILS	KOLDFORM™ LC- 702
COOLING CAPACITY	5.26 KW (1.5 TR) @50°C / 7.02 KW (2.0 TR) @ 35°C
NO. OF REFRIGERANT CIRCUITS	One
COMPRESSOR TYPE	Hermetically sealed Vertical Scroll Type
AIRFLOW	1090 CMH
MAXIMUM AMBIENT TEMP. FOR OPERATION	60°C
POWER & CONTROL SUPPLY	415 VAC 3-phase 50 Hz, 110 VAC
MAX. POWER CONSUMPTION IN COOLING MODE	2.6 KW (Max.) @ 35 °C ambient temp.
REFRIGERANT	R-407C
LOW PRESSURE CUT-OUTS	0 – 7.5 bar
HIGH PRESSURE CUT-OUTS	8 – 32 bar
OVERHEAT PROTECTION	Compressor: In-built overheat sensors Incoming Cables: Thermal overload protection
CONDENSER FAN	415 V 3-phase 50 Hz, Induction Motors
EVAPORATOR FAN	415 V 3-phase 50 Hz Induction Motors
AIR INTAKE FILTER	Non-Woven material
CONTROL CIRCUIT	Electronic thermostat-based control unit with LCD display
GROSS WEIGHT	140 Kg. (Approx.)
ENCLOSURE MATERIAL	Stainless Steel SS-304
DIMENSIONS (INCL. MOUNTING)	1146mm (L) x 1000mm (W) x 430 mm (H)



Locomotive Driver Cab AC Inner Product View

Picture of actual installed product
on Locomotive Driver Cab



Split Air-conditioner for Alco Locomotive

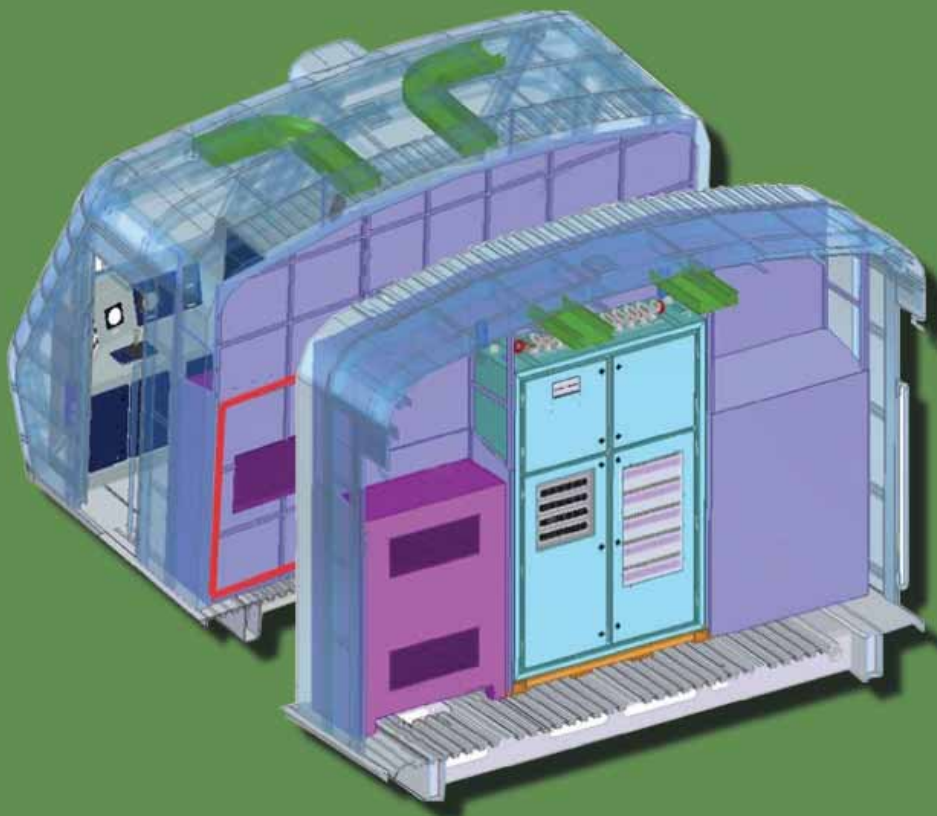
Each RMAC houses hermetically sealed horizontal scroll-type compressors configured vapor compression circuits, each with its own condenser, evaporator, filter drier, liquid line sight-glass, and a thermostatic expansion valve. These installation and maintenance friendly units are housed inside a stainless-steel housing and come with integrated control panel and switchgear mounted inside the roof module itself.

PRODUCTS

CAB AC FOR EMU / MEMU TRAINSETS

Continuing our tradition of innovation in on-board HVAC technology, Prag introduced the first ever driver cab air-conditioning for Mumbai Suburban EMU service in 2017. The unique tower-type system was designed to maximize operating performance with minimum solar radiation and optimized air circulation. Subsequently additional variants of the product have been developed and introduced for use in MEMU (Mainline EMU) Coaches, which have also been duly approved by the Indian Railways and are in service.

The Koldform™ T-770 and Koldform™ T-440 Tower Type HVAC Units are in successful service in more than 100 EMU / MEMU trains across the country today. The design allows for easy installation and maintenance and can be retrofit in existing EMU / MEMU Driver Cabs with minimal structural modification.



TECHNICAL DETAILS

KOLDFORM™ T- 770

KOLDFORM™ T- 440

Modes of Cooling	User selectable three-point temperature cooling mode (21°C, 24°C & 27°C)	User selectable two-point temperature cooling mode (23°C & 25°C)
Cooling Capacity	7.04 kW (2.0TR) based on 50°C ambient temperature	4.39 kW (1.25TR) based on 50°C ambient temperature
Compressor Type	Hermetically Sealed Vertical Scroll type	Hermetically Sealed Vertical Scroll type
Controller	Electronic Thermostat	Electronic Thermostat
Air Flow	1150 m³/hour	760 m³/hour
Power Consumption	4.5 kW	2.9 kW
Power & Control Voltage	415VAC 3-phase 50Hz & 110 VAC	415VAC 3-phase 50Hz & 110 VAC
Refrigerant	R134a	R-407C
Condenser Fan Motor	415VAC, 3-phase 50 Hz	415VAC, 3-phase 50 Hz
Evaporator Fan Motor	415VAC, 3-phase 50 Hz (Controlled with three speed circuit)	415VAC, 3-phase 50 Hz
Filter	Re-Usable	Re-Usable
Heat Exchanger	Copper tubes expanded in the Al fins	Copper tubes expanded in the Al fins
Dimensions (Including Mounting)	(W X D X H) 956mm X 348mm X 1394mm	(L X W X H) 1000mm X 880mm X 452mm
Gross Weight	200 Kg approx.	150 Kg approx.
Enclosure Material	SS304 Stainless Steel	SS304 Stainless Steel



KOLDFORM™ T- 770



MAINLINE PASSENGER COACH AIR CONDITIONING



Prag offers a range of standard and bespoke Roof Mounted AC Package Units for railway passenger coaches. The Koldform™ R-2500 is used on Indian Railways' Mainline (LHB) Coaches and is manufactured in accordance with RDSO Specification No. RDSO/PE/SPEC/AC/0061-2005 (Rev. 01). The product is duly approved by RDSO for use on Indian Railways passenger stock.

With a history of breakthrough innovations in railway HVAC, in 2018, Prag was given the opportunity to design and manufacture the passenger coach air conditioning for Indian Railways' prestigious Vande Bharat Express – India's first self-propelled trainset. The Koldform™ R-2840 HVAC Unit was developed in record time and was the first major upgrade in Indian Railways' passenger coach air-conditioning in over a decade. Some salient features include:

- Enhanced Cooling Capacity – 8.0 TR (28.4 kW) based on 50°C ambient
- Flame-Retardant Leak-proof bellows made with meta-aramid fabric
- In-built smoke detectors at incoming fresh air as well as return air inlets
- Built-in emergency inverter with transformer activating emergency blower

TECHNICAL DETAILS

MODES OF OPERATION

COOLING CAPACITY

HEATING CAPACITY

COMPRESSOR TYPE

CONTROLLER

AIRFLOW

HEATING POWER

POWER & CONTROL VOLTAGE

REFRIGERANT

FRESH AIR SUPPLY

CONDENSER FAN MOTOR

EVAPORATOR FAN MOTOR

FILTER

HEAT EXCHANGERS

DIMENSIONS, INCL. MOUNTING

GROSS WEIGHT

ENCLOSURE MATERIAL

EMERGENCY MODE

SMOKE DETECTOR

TCMS INTERFACE



KOLDFORM™ R- 2500

KOLDFORM™ R- 2840

	Cooling, Heating, Emergency, and Dehumidification	Cooling, Heating, Emergency, and Dehumidification
	24.57 kW (7.0 TR), based on 50°C ambient temperature	28.4 kW (8 TR), based on 50°C ambient temperature
	6 kW	6 kW
	Hermetically sealed Vertical Scroll Type	Hermetically sealed Vertical Scroll Type
	Microprocessor Based Controller with data logging	Microprocessor Based Controller with data logging
	4,000 CMH	4,000 CMH
	6kW	6kW
	415 VAC 3-phase 50 Hz, 110 VDC / 24 VDC	415 VAC 3-phase 50 Hz, 110 VDC / 24 VDC
	R-407C	R-407C
	3120 m³/hr per car	1170 m³/hr per car
	415 V 3-phase 50 Hz Induction Motors	415 V 3-phase 50 Hz Induction Motors
	415 V 3-phase 50 Hz Induction Motors	415 V 3-phase 50 Hz Induction Motors
	Non-woven material, Accessible from car roof	Non-woven material, Accessible from car roof
	Grooved Copper tubes expanded in the Al fins (Pre-Coated)	Grooved Copper tubes expanded in the Aluminium fins (Pre-coated)
	2220 mm (L) x 2180 mm (W) x 560 mm (H)	2565 mm (L) x 2324 mm (W) x 480mm (H)
	665 Kgs.	950 Kgs. (including electrical control panel)
	SS304 Stainless Steel	SS304 Stainless Steel
	—	In-built emergency inverter and transformer
	—	Two smoke detectors
	—	Provided

PRODUCTS

SUBURBAN PASSENGER COACH AIR CONDITIONING

The Koldform™ R-5280 Suburban Train HVAC is designed to meet the demanding climatic conditions as well as the high passenger density observed in Indian metropolitan areas with peak passenger loading of up to 570 passengers in one rail car.

TECHNICAL DETAILS

KOLDRORM™ R- 5280

Modes of Operation	Cooling, Heating, Emergency & Dehumidification
Cooling Capacity	52.80 kW (15TR) at 38°C Ambient
Compressor Type	Hermetically Sealed Horizontal Scroll type
Controller	Microprocessor based controller with data logging
Air flow	7,000 CMH \pm 10%
Fresh Air	3,120 CMH
Power & Control Voltage	415VAC 3-Phase, 50 Hz & 110 VDC/24VDC
Power of unit	21kW
Refrigerant	R-407C
Condenser Fan Motor	Induction Motor 415VAC 3-Phase, 50 Hz
Blower Fan Motor	Induction Motor 415VAC 3-Phase, 50 Hz
Filter	Non-Woven Material, accessible from top of car roof
Heat Exchanger	Grooved Copper tubes, expanded in Copper fins
Size (including Mounting hook)	(L X W X H) 3000mm X 2135mm X 430mm
Weight	950Kg approx.
Enclosure Material	SS304

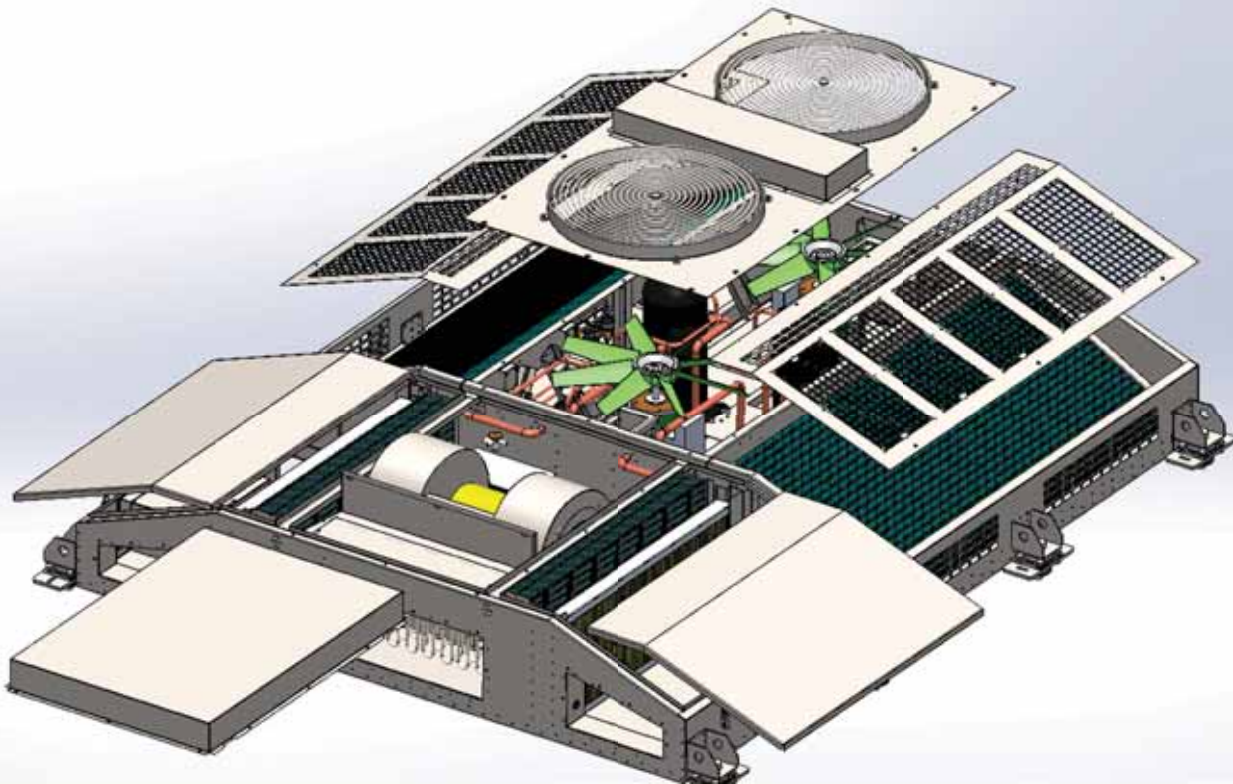


The Koldform™ R-5280 Roof Mounted HVAC Unit provides a cooling capacity of 15 TR at 38°C ambient temperature. In order to ensure an acceptable air quality on-board the commuter cars, the unit provides an airflow of 7,000 CMH with a fresh air supply of 3,120 CMH maintaining a positive pressure while supplying large amounts of fresh air to the passenger area.



PRODUCTS

REVERSE CYCLE HVAC SYSTEMS WITH INVERTER



The Koldform™ R-2840C Roof Mounted Modular Air Conditioning System provides 28.4 kW of cooling and 6 kW of heating through reverse cycle and ensures a cabin temperature of 20 – 25°C max in a 45°C ambient. The system consists of two parallel refrigeration circuits for redundancy and is fitted with a variable frequency scroll compressor for capacity control, providing one of the most energy-efficient ways to heat and cool the passenger compartment. The reverse cycle heating system provides increased fire-safety in passenger coaches by eliminating heating elements altogether. The system is also equipped with clogged-filter sensors and CO₂ sensors that monitor the air quality inside the coach.

TECHNICAL DETAILS

KOLDFORM™ R- 2840C

Modes of Operation	Cooling, Heating, Emergency & Dehumidification
Cooling Capacity	28.4kW (8TR)
Heating Capacity through Reverse Cycle	6 kW
Compressor Type	Variable Frequency scroll compressor, Frequency variation is between 40-80Hz
Controller	Microprocessor based controller with data logging
Air flow	4000 ± 10% CMH
Fresh Air	3120 m³/Hr.
Power & Control Voltage	415VAC 3-Phase, 50 Hz & 110 VDC/24VDC
Power of unit	18kW
Refrigerant	R-407C
Condenser Fan Motor	Induction Motor 415VAC 3-Phase, 50 Hz
Blower Fan Motor	Induction Motor 415VAC 3-Phase, 50 Hz
Filter	Non-Woven Material with activated carbon
Heat Exchanger	Grooved Copper tubes, expanded in Pre-Coated Aluminum fins
Size (including Mounting hooks), L x W x H	2,220mm x 2,180mm x 560mm
Weight	665 Kg approx.
Enclosure Material	Aluminum as per EN573-3(2009) (F)
Inverter Supply Voltage	380-500 VAC
Inverter Supply frequency	50-60 Hz
Inverter Power	6 kW to 7.5 kW
Inverter Output Voltage	380-500 V
Filter Clog Indicator	2 Nos
CO ₂ Sensor	Yes

PRODUCTS

CONTROL PANELS & SWITCHBOARD CABINETS

Prag manufactures switchboard cabinets consisting of power / control switchgear and microprocessor-based power /control panels for easy operation and maintenance of the Koldform™ units installed in Passenger Coaches. We also design, manufacture, and supply, custom-built medium and low voltage electrical switchboards for railroad and other applications.

Our Switchboards are fully tested and certified according to the requirements of IEC 60497 & UIC 550 standards. Prag switchboards comply to RDSO Specification No. RDSO/PE/SPEC/AC 0184 – 2015 and have been duly approved by the Indian Railways for use on Railway Passenger Stock.

Being one of the top suppliers of onboard electrical equipment, Prag HVAC Power / Control Panels and Switchboard Cabinets are known for their quality and reliability. The raw materials for switchgears and other electrical equipment are procured from top OEMs such as L&T, Schneider, ABB, and Wago.





WATER PURIFIERS AND COOLERS

The Prag Arcticove® Water Purifier System, built using NSF Certified Multi-Bore Ultrafiltration technology with intermittent auto-flushing arrangement, has been in active service in IR Passenger Coaches since 2016. The Prag Arcticove® Water Purifier-cum- Cooler System is an integrated-purifier-cum-cooler system having a robust vibration-resistant and vandal-proof stainless-steel construction specifically for on-board use on railway passenger coaches developed in 2018.



Maintenance Free

The long-life Multibore membrane is designed to perform continuously for a period of eighteen months in an IR Passenger Coach, even at full capacity utilization.



Certified Virus Retention

Certified Log-5 Virus Rejection [MS2 Phages] – IWW, Germany.



Certified Food Grade

Filtration membrane and accessories certified as per NSF / ANSI 61.



Bacteria Free

Meets international drinking water standards, Bacteria removal efficiency: 99.9999%.



Retains Natural Quality of Water

All the natural salts and minerals in the water are retained without adding iodine or other chemicals.



Minimal Water Wastage

The system is designed for less than 2% Water Wastage.



Auto-Flush with Timer

Ensures regular auto-cleaning of Filter Membranes.



Robust Construction

Vandalism Proof Stainless Steel Construction.



IP 65 Protection

All electronics used have IP-65 Level protection.



Last Point Purification

Water is first cooled and then purified, leaving absolutely no chance of contamination.

The Arcticove® WPCS utilizes innovative multibore ultrafiltration technology using nanoscale membranes to provide safe potable drinking water to railway passengers. Water is cooled in a 25-liter stainless steel insulated tank ensuring a continuous supply of cold water even in peak summers and passenger loads. Cold water stored in the tank is filtered in-situ before dispensing, leaving absolutely no chance of contamination.

DIMENSIONS IN MM (H x D x W)	700 x 430 x 460
NET WEIGHT (KGS)	100 (APPROX)
PRIMARY FILTRATION MEMBRANE	MULTIBORE ULTRAFILTRATION CARTRIDGES
FILTRATION PORE SIZE	<0.02 MICRONS [100,000 DALTONS]
FLOW RATE / FEED PUMP CAPACITY	120 LPH (2.0 LPM)
INPUT VOLTAGE	110VAC [110VAC TO 24VDC CONVERTOR INBUILT]
PRE-FILTER	5 Micron
INDICATION PANEL	ELECTONIC LED BASED PANEL WITH FAULT SIGNAL
DISPENSING MECHANISM	PUSH BUTTON, PRESS & HOLD TO DISPENSE
TIMER BASED AUTO-FLUSH	FORWARD-FLUSH FOR 5 SECONDS EVERY 30 MINUTES
WEATHERPROOF CONSTRUCTION	IP-65 LEVEL PROTECTION IN ALL ELECTRONIC ENCLOSURES
DRY-RUN PROTECTION	AUTO SYSTEM SHUTDOWN UPON 10 SECOND DRY-RUN
ANTI-CHOKING	AUTO SYSTEM SHUTDOWN @2.5 KG/CM ² WATER PRESSURE
COOLING SYSTEM	
COLD WATER STORAGE	25 LITERS
COMPRESSOR INPUT VOLTAGE	110 V AC
INSULATION	PUFFING
HEAT DISSIPATION	LOUVERS ON BOTH SIDES, PERFORATED SHEET AT THE BACK
TOTAL POWER REQUIREMENT	500 WATTS
IR SPECIFICATION NO.	RDSO-015/CG-04 of JULY 2016

CUSTOMER SUPPORT

Our goal is to provide every customer – no matter where they are – with open and fair pricing on all of our products, prompt support, and superior after-sales service. Our physical presence in each and every railway zone combined with the excellent skills of our engineers means that we can provide the best possible service in a timely and effective manner while always adhering to the highest levels of quality.

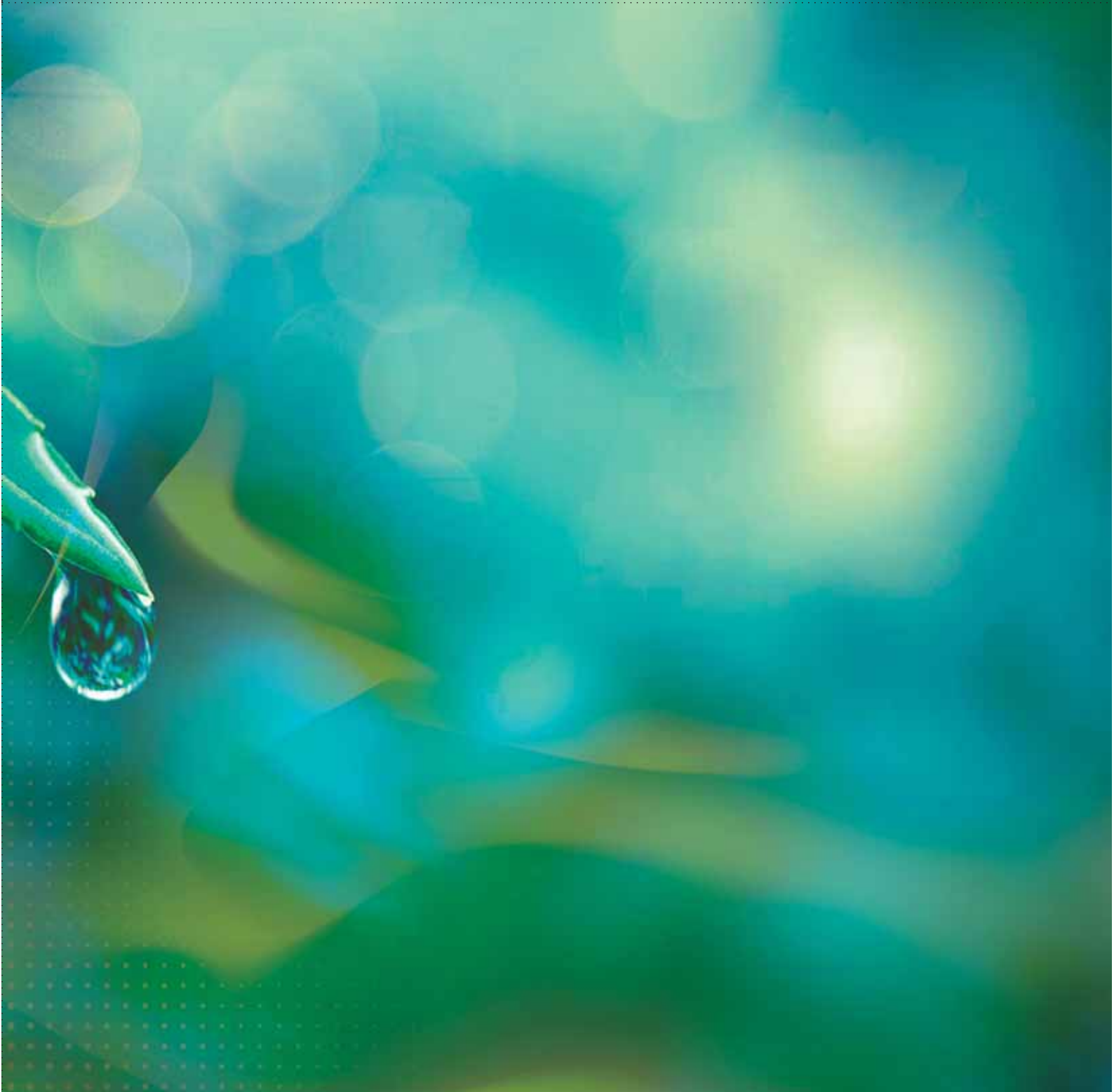
Our support services include:

- HVAC-R Warranty Support
- On-site installation & commissioning support
- Preventive, Corrective and Maintenance services
- Arrangement and supply of spares for HVAC equipment
- AMC offering round the clock support and maintenance
- Comprehensive Maintenance Contracts including:
 - Trip Inspection
 - Maintenance / Overhaul at specified intervals
 - Repair on request of operator
 - Provision of spares & consumables
 - On-site Refurbishment of HVAC Systems



PRAG SERVICE LOCATIONS





PRAG POLYMERS
REDEFINING MOBILITY®

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