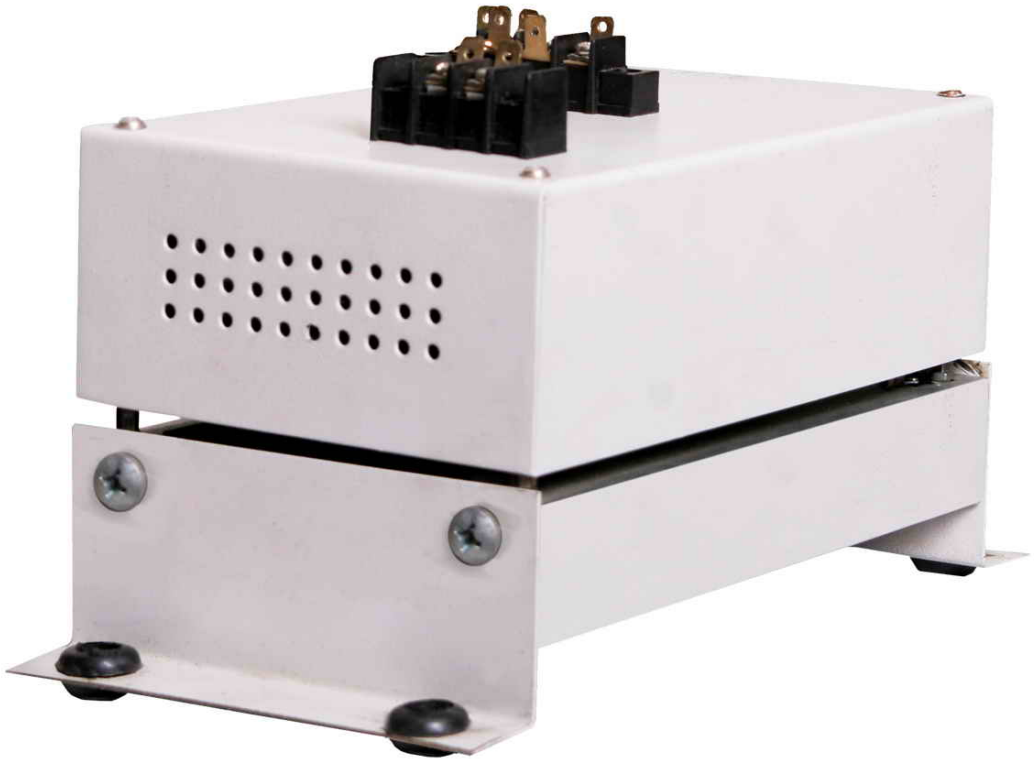
DC/AC REFRIGERATOR INVERTER UNIT

Locomotive Refrigerator's Part
A device for various applications in locomotive



World Part Supplier Inc.

Engineering Department

http://www.WPSupplier.com

WORLD PART SUPPLIER

(Engineering, Design, Manufacturing, Maintenance, Consulting)

Locomotive Refrigerator Inverter 74VDC to 110VAC
Exclusive Design

Part Number: WPS-3001

Equal Part Number: I111684-3

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M2N 6H8

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WPS-REFINVERTER-18

Specification of Unit:

In common word we name this unit: "Inverter".

Sine Wave Inverter Unit P/N: WPS-3001 supplies required power to the any device that uses 115 VAC, 1.4KW power such as refrigerator of EMD, GE, Hitachi or any other kind of locomotives that feeds 74VDC through power source (i.e. auxiliary generator). This unit has been designed according to the recent electronic elements and parts in market and all design technology is local and belongs to World Part Supplier Co. This unit gets 74VDC and converts it into 115VAC. This power is used in locomotive driver cabinet refrigerator or any other devices required this power. It has been designed in a manner to produce 115VAC constantly with the input variety from 64 to 90VDC. In this range of input, we guarantee constant output voltage without drop in amperage.

Inverter is designed for 1KW power. Its wave shape is sine wave. Therefore the necessary start current is lower than rectangular wave. It causes less power shock on power consumer devices thus its lifetime increases.

Railway operators can use this device as power supplier for various applications such as “Locomotive Cab Refrigerator’s Compressor, Cellphone Chargers, Flash Light Battery Chargers etc.”

8.8A output current of this unit while we have 115VAC output, is assured. This unit has the ability to produce momentarily (peak) current of 20A for 4 seconds. This can be used by compressors with low efficiency.

We have tried our best to reduce the internally produced heat on inverter's circuit. Device has been designed in a manner to outstand 60 Celcius ambient temperature if there is appropriate air circulation around inverter unit.

If we do not provide enough air flow around inverter, its temperature raises, therefore it will cut the power off and will shut the system down to cool down the elements. We have designed unit in a way to go in hibernate mode while system operating temperature is high.

Herein we have briefly listed operational logic of inverter:

- As soon as input power connects, system checks itself for 5 seconds.
- Inverter is bi-polar.
- If system checks itself and finds out any fault signal in its circuits, inverter will restart and re-control itself. If health signal gets collected from whole circuit, the high power side will get powered.
- If the input voltage of inverter is within 64 to 90VDC, device will control input current.
- If input current is within design limits, device will control other parts of its circuit.
- Any possible fault in input circuit will cause system automatic shut down.
- Assuming the right feedback from internal circuits, the output power segment will be energized.
- Unit controls its output power second by second and collected information is analyzed by system.
- If for any reason, the output voltage deviates from designed range, device will consider it as a fault and will restart itself.
- If for any reason, the output current exceeds designed maximum range or remains in the maximum range of design point for the time longer than normal, inverter will sense it as a fault and will restart itself in order to fix the mistake.
- In any circumstances if the output current exceeds maximum and minimum dedicated levels, unit will restart itself.
- The ambient and inverter's elements temperature are under protracted control and if for any reason the temperature rises above the design point, unit will shut the power off until the temperature gets back in normal condition as defined in design points.

In one view, we can demonstrate the operational logic of inverter part number WPS-3001 as shown in the presented flowchart. (Diagram number 1- definition of logical operation of Inverter WPS-3001)

We have done repeated temperature control tests and have checked the temperature raise vis-à-vis the time considering the ambient temperature and air flow. All registered records prove that inverter has very endurance for temperature raise and reacts in proper temperature.

In all normal conditions –good air flow, normal ambient temperature, and normal humidity- inverter gives good and reasonable values of thermal tests.

Our engineering department has done different full load tests -keeping the unit under full load for 72 hours, facing the unit with abnormal conditions such as shorted circuit or overload and rapid overload-. In all cases this unit has proved good results.

Our engineering and design department has done different destructive tests on the unit such as checking the stability of unit in 70-Celsius temperature, 90% environmental humidity and creating short using external elements on the output circuit while inverter was assembled on a refrigerator. We are proud to say that all performed tests approved and confirmed our production as an authorized device to be used in railways and mobile or sever usage conditions.

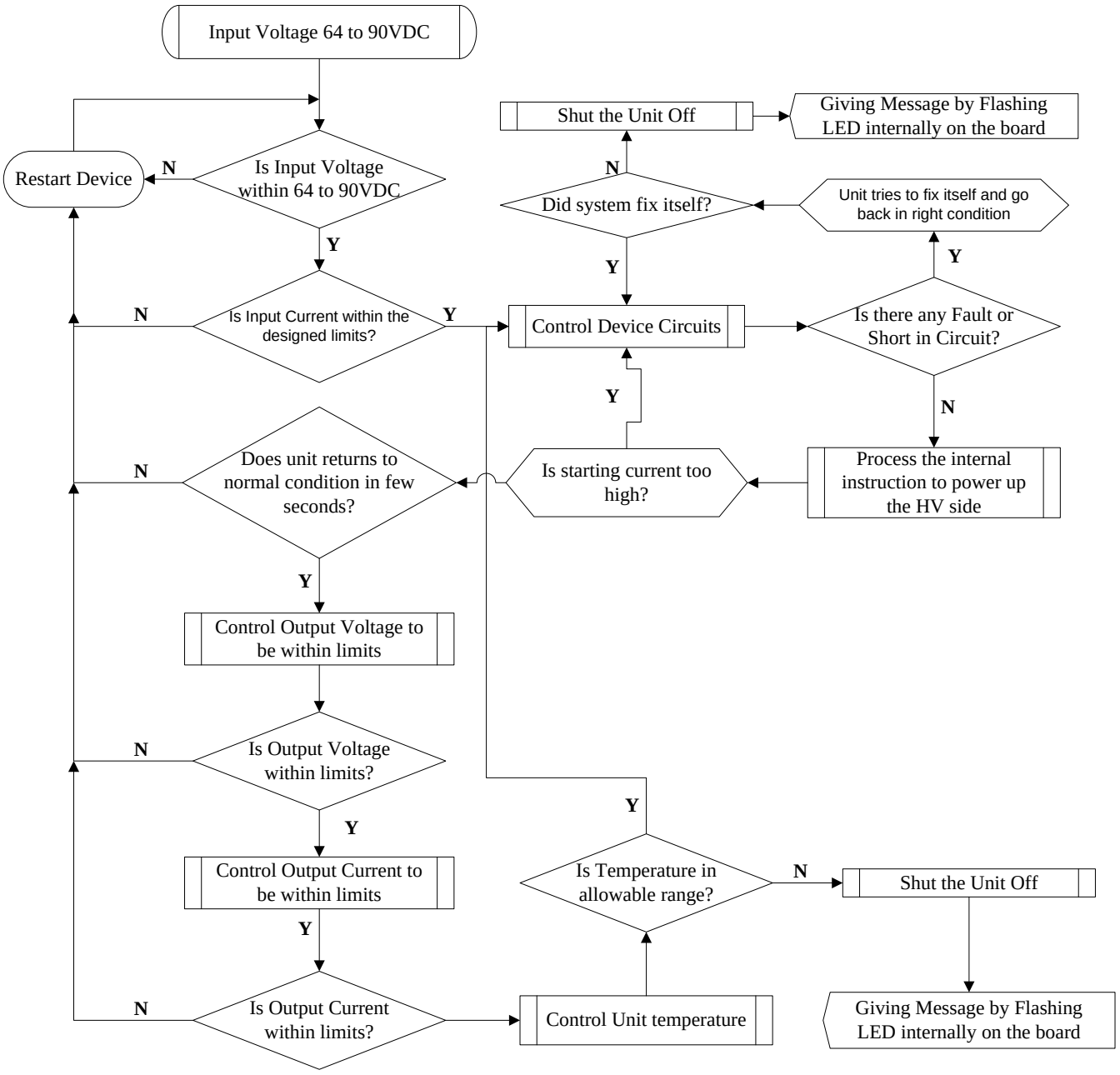


Diagram number 1- operational logic definition of Inverter VSPG-3001

Inverter Visual Specification:

Length of unit is 225mm and its width is 120mm and total height of unit is 110mm. Please see drawing number "3001-03-WPS-Manuf" for complete details.

Device has two isolated segments: low power section and high power section. Auxiliary generator of locomotive will feed incoming power. Considering the auxiliary generator as an incoming direct voltage power source we will have guaranteed 74VDC input to the inverter.

The output segment of inverter has 4 connections. One connection is common between three other connections. Schematic of wiring and connections is shown in drawing number WPS-3101-REF. As you see, connection N°1 and N°2 act as a switch. Inverter has been designed for NO condition in default mode. However depending on the switch, by using a jumper we can change form NO to NC circuit. Inverter is equipped for this function. When switch is energized, it feeds the power for other outputs.

Other connections are for power users such as cooling fan, compressor etc.

We have considered delay time of 30 seconds between the first and second power output.

In any circumstances and at any step of processes, if inverter encounters a defect, it will restart whole system.

We have considered security circuits on whole device to reduce the risk of hazardous damages on system. We have tried our best to design a system that will face less damages and cost of maintenance.

Troubleshooting:

▪ Unit Does Not Turn On:	1. Check the input power cord. Do you have input power to inverter unit? 2. If you have input power to the unit, check whether you have input voltage in the range of 64 to 90 VDC. If the voltage was out of range, fix the problem externally out of inverter device. 3. Check the switch circuit. Probably the switch does not work. 4. If none of the above possible problems have occur, disconnect the inverter from wires and contact our after sale services department.
▪ Unit controls itself and restarts repeatedly:	1. Unplug the input power of unit. 2. Disconnect all output connections. 3. Make a short between connector N°1(Thermo) and N°2 (Comm). 4. Re-plug input power cord. 5. Wait between 5 to 7 seconds. Do you hear inverter start up siren? If your answer is "YES" please find the deficiency in inverter's power consumer devices or parts. If your answer is "NO" please unplug input power and disconnect wires and contact Vista Sanat Persian's after sale services department.
▪ Inverter turns on but after a while shuts down:	1. Check the input voltage to be in the range. 2. Measure the output maximum current (surge current). 3. Is it above 20A? If your answer is "YES" please check your power consumer parts. If your answer is "NO" please calculate the time of surge current. If inverter can produce 20A for 4 seconds, check your consumer parts for abnormal conditions. If inverter cannot produce 20A for 4 seconds, let the unit to restart for 5 times. If problem is not fixed contact our “after sale services” for further action. 4. If the starting current and normal period current are intact but unit gets in trouble after sometimes, study the situation to find out what happens that causes such defect? Whether after fixing the output current and stabilizing the unit condition, the current begins to increase? If your answer is "YES" please check your external power consumer devices or parts to find the defect. If your answer is "NO" please control heat sink temperature. If it is above 90 Celsius, please take necessary action to create good air flow around inverter.
▪ One of the outputs is inactive:	1. Switch the output connection.

	2. Does the part which was inactive in prior condition, work? If your answer is "YES", disconnect the unit and contact our “after sale services” department. If your answer is "NO" then inverter is intact and you must change the defected consumer part.

Very important note:
This unit has two completely isolated input and output sections. It means that in case of defect in each section, the other section will not get affected.

Note:
This unit is equipped by anti-short protection system. It means that if for any reason, system encounters “short” in the circuit, unit automatically will reset itself and will restart the operation. We have applied this preference to protect other parts and elements of inverter when inverter faces any probable short.

Note:
This unit has safety protection system against the high current consumption. In case of having high current consumption, this unit will cut the current and when the problem is solved, it restarts functioning normally.

Cautions:

1. Never open the cover of Inverter Unit.
2. Avoid replacing the wires of connectors.
3. Avoid impact and strike shocks on unit.
4. As far as possible try to not use this unit in the ambient that has high continues humidity.
5. Really avoid using water or other washing liquids and detergents on this unit.
6. Really avoid pouring acids and alkalis and alkaloids.
7. Never put the unit in magnetic fields.
8. Never keep inverter in the circuit or in neighboring a circuit that you want to do Megger test on it.
9. Never keep inverter in the circuit or in neighboring a circuit that you want to do Hi-Pot test on it.
10. Really avoid of connecting the input connectors to AC power.
11. Really avoid making short on output connectors of unit.
12. Do not scratch the wire's shell (sealing wax) of coil beneath the inverter.
13. Rubber washer around the mounting hole of inverter brackets are for isolating the unit from the extremity circumferences. We strongly recommend to not removing it if your system is sensitive for inducted voltage etc.

Each Inverter Unit part number: WPS-3001 has a Serial Number for Further tracing purposes such as date of Production, Date of Sale, Date of Warranty start, Warranty period etc.

Note:
We supply this unit with 2 type of cover: Metal and Plastic. You see inverter with metal cover in first pages. We offer type of inverter with metal cover.

WPS-3001 Technical Specification in one shot:

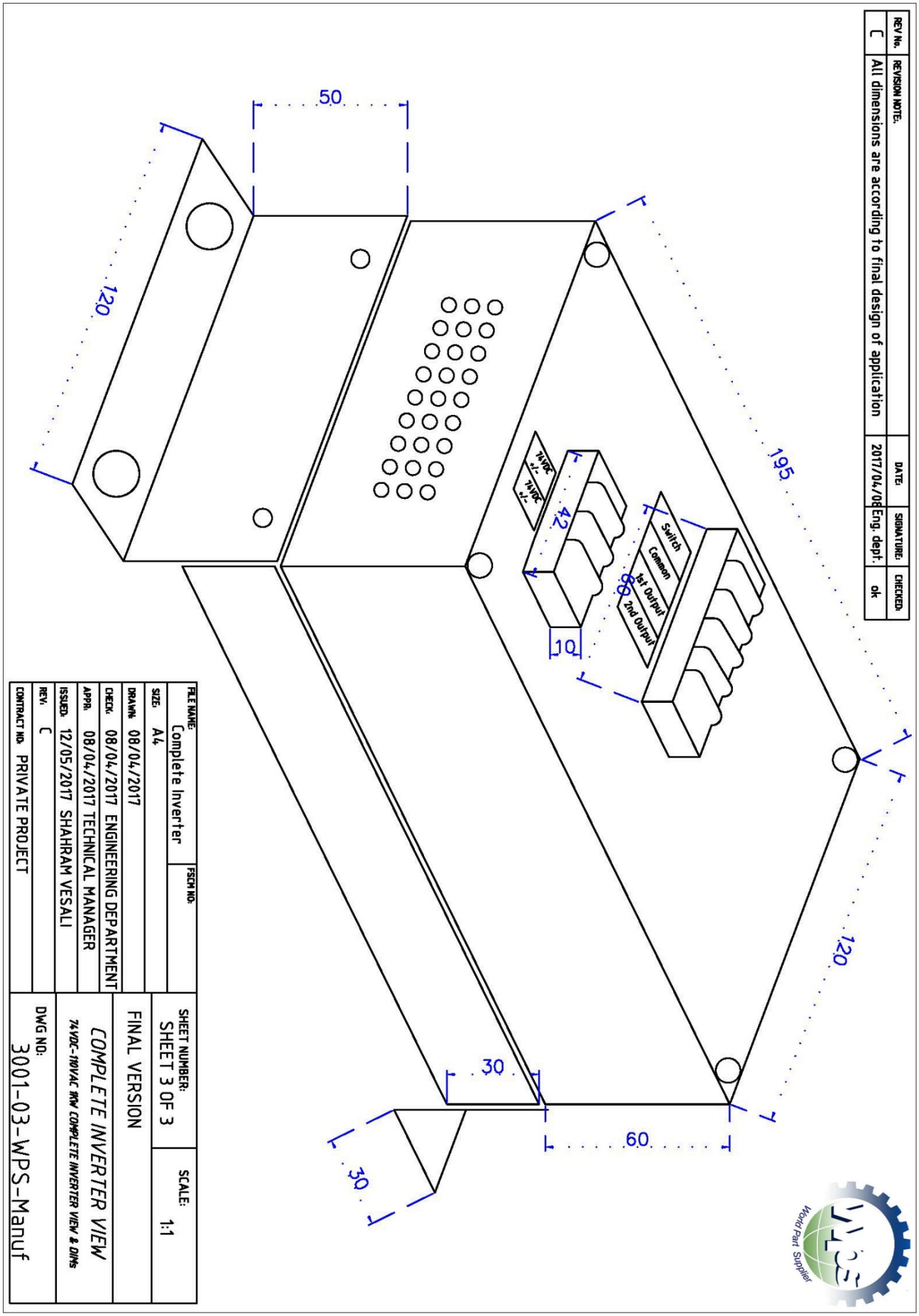
Part Technical Name:	74VDC to 115VAC 50Hz inverter 1KW
New Part Number:	WPS-3001
Equal Part Number:	I111684-3
Operational Input Voltage Range:	64 to 90VDC
Output Voltage:	Guaranteed 115VAC with Max -1VAC Deviation
Nominal Continuous Current Supplied by Unit:	Guaranteed 8.8A
Continuous Current for Short Time:	20A for 4 Seconds
Stand for Over Current Caused by Short:	20A for 4 Seconds
Operational Ambient Temperature Range:	-20 to +60 Celsius
Can be used on:	EMD, GE and Hitachi locomotive and whatever demands such specification

Thermal Control:	Yes
Output Over Current Control:	Yes
Output Under Current Control:	Yes
Output Over Voltage Control:	Yes
Output Under Voltage Control:	Yes
Input Over Current Control:	Yes
Input Under Current Control:	Yes
Input Over Voltage Control:	Yes
Input Under Voltage Control:	Yes
Method of Control on Voltage and Current:	Electronically Smart
Current drop value to voltage changes:	Zero in defined range for inverter normal function
Others:	• Isolated input and output • Available with plastic or metal Cover • Bi-polar input power

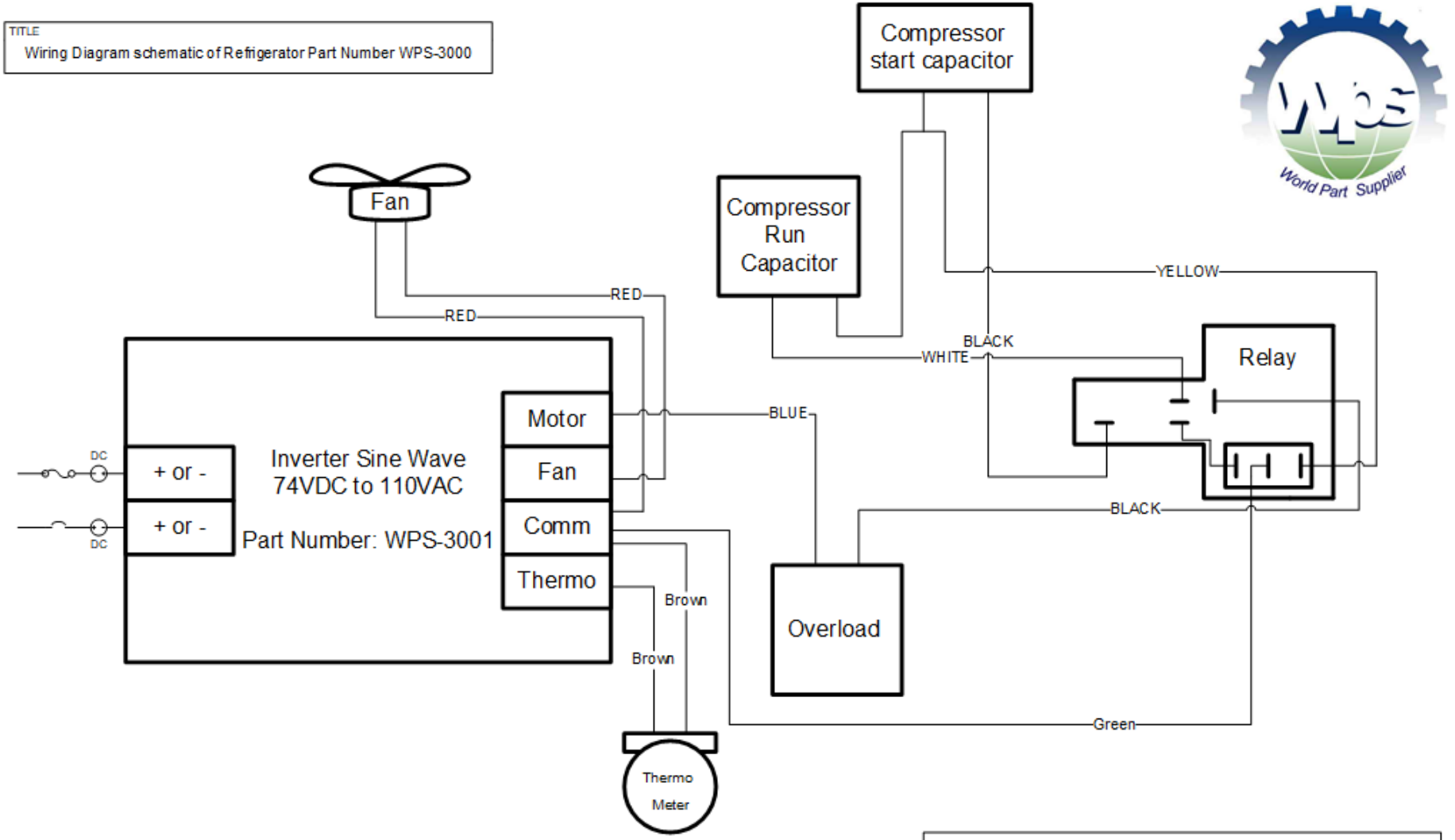
Mechanical Drawings of Inverter external box and sizes and schematics:

3001-03-WPS-Manuf ➔ Drawing of mechanical dimensions of 1KW inverter cover

WPS-3101-REF ➔ Schematics of inverter connectors and wiring between inverter and power consumer parts (it is shown as a sample)


REV No.
REVISION NOTE:
DATE:
SIGNATURE:
CHECKED:
C
All dimensions are according to final design of application
2017/04/08
Eng. dept.
ok
50
120
195
74VDC +/-
74VDC +/-
42
10
80
Switch
Common
1st Output
2nd Output
120
30
60
30
World Part Supplier
FILE NAME: Complete Inverter
FSCM NO:
SIZE: A4
SHEET NUMBER: SHEET 3 OF 3
SCALE: 1:1
DRAWN: 08/04/2017
FINAL VERSION
CHECK: 08/04/2017 ENGINEERING DEPARTMENT
APPR: 08/04/2017 TECHNICAL MANAGER
COMPLETE INVERTER VIEW
ISSUED: 12/05/2017 SHAHRAM VESALI
74 VDC-110 VAC 1KW COMPLETE INVERTER VIEW & DIMs
REV: C
CONTRACT NO: PRIVATE PROJECT
DWG NO: 3001-03-WPS-Manuf

TITLE
Wiring Diagram schematic of Refrigerator Part Number WPS-3000



Item	Description	Part Number	QTY
1	Thermometer non adjustable	WPS-3011	1
2	Inverter 1KW Sine Wave	WPS-3001	1
3	Compressor rotary110VAC	WPS-3002	1
4	Condenser Cooling Fan	WPS-3005	1
5	Overload relay	WPS-3003	1
6	Compressor RUN Capacitor	WPS-3007	1
7	Compressor Start Capacitor	WPS-3006	1

WORLD PART SUPPLIER Inc.		
Date: 2017-11-10	Wiring Schematics of Refrigerator	
	Revision: REV B	Size: A4
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