



ANDHRA PRADESH STATE ROAD TRANSPORT CORPORATION

No.TR1/815(32)/2008-MED

O/o The VC & MD,
Hyderabad-624.

CIRCULAR NO. 06/2010 – MED, Dt : 29.03.2010

SUB : **TOOLS & PLANTS** – Importance of maintaining accurate prescribed inflations – **Standardization of Automatic Tyre inflators.** - Reg.

REF : Lr No:TR1/584(1)/2008-MED, dt.01.04.2008.

The pneumatic tyre is designed to deflect at a predetermined percentage under a given load and inflation with specified air pressure. It means the air pressure which carries the vehicle load influences the deflection of Tyre casing. The correct deflection results in proper contact of the crown area with the road surface. **Proper deflection is therefore very vital for satisfactory tyre performance.** As the deflection in turn depends on Tyre inflation, it is an indispensable fact that **the Tyre performance depends to a greater extent on proper Tyre inflation.** Both the cases of under inflation and over inflation are very much harmful to the Tyre.

Majority of the Tyre failures such as tread separation, ply separation, through cuts, etc. at early stage are due to **under inflation** only. Besides, under inflation also causes premature failure of patches and other major repairs on the tyres.

In case of **over inflation**, the tyres are subjected to concussion, impact failures leading to premature failure. Over inflation not only kills tyre abruptly but also reduces its tread life due to faster wear in the center of crown area.

Therefore **ensuring correct tyre pressures is of utmost significance for achieving the maximum Tyre life.** At present this vital aspect is observed to be neglected at many places resulting in poor tyre performance. The recent random inspection of tyres conducted at various bus stations revealed gross irregularities in tyre inflation on majority of vehicles. On an average, **8 %** of tyres were found with under inflation and **19 %** of tyres with over inflation which is of major concern in Tyre maintenance.

Keeping in view the importance and **to ensure more accurate inflations, conventional (analogue) inflating gauges were replaced with Digital gauges in the year 2005.** The digital gauges standardization also avoided parallax errors that used to take place in case of analogue gauges. **Even with Digital gauges, human failure of erroneous inflation more or less than the prescribed could not be avoided. Further, in the present system of checking tyre pressures, lot of compressed air is also getting wasted resulting in higher energy consumption.**

In order to eliminate the above problems and to simplify the system of ensuring accurate tyre inflation reducing **human fatigue also**, it is decided to use **Automatic Tyre Inflators (ATIs)** in place of the existing digital gauges. ATI is an upgraded version of conventional digital gauge.

P.T.O

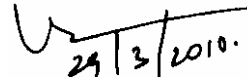
The **added advantages** of upgraded technology are: it **automatically cuts off** at the prescribed (already set) pressure avoiding the possibility of human error to keep high or low air inflations; it has also got the **system of deflating** the Tyre with higher inflations to the prescribed inflation; **conservation of compressor energy** to the optimum levels.

Action was already taken to introduce them initially at GNT-II, MCL, VJA, ELR, BVRM and MTM on experimental basis. Then basing on **satisfactory performance**, the number has been increased and at present there are **56** ATIs at different Depots of the corporation.

To derive the full advantages of **Automatic Tyre Inflators**, it is now decided to make it **depot standard equipment** continuing the existing norm of **ONE** for each **20 vehicles with minimum 3 numbers in a Depot**. The salient features along with operating principles are annexed to this circular. Hereafter any replacement of existing gauges shall be done with Automatic Tyre Inflators only. As far as **Master gauge** is concerned, it shall be the **conventional Digital gauge only**. In no case it shall not be replaced with ATI.

The **contract cell** shall initiate procurement action to get the bulk order advantage and communicate the rates to the Zones for further action at their end.

The **Dy.CMEs** are advised to ensure proper working and to monitor the performance of Automatic Tyre Inflators at depots of their jurisdiction. If necessary the instructions on operation of the equipment may be prepared in Telugu and displayed at appropriate & conspicuous place in the garage.


29/3/2010.

Vice Chairman & Managing Director

Copy to : Dir.(V&S), ED(E&IT), ED(A&P), ED(O), FA, CAO and ED(T&C) for information.

Copy to : All EDs(Zone) for information and necessary action.

Copy to : CCOS, CME(O), CME(C&B) & CE(E&IT) for information and necessary action.

Copy to : All Regional Managers for information and necessary action.

Copy to : All WMs/COSs for information and necessary action.

Copy to : All Dy.CAOs & AOs for information.

Copy to : Dy.CME(O), Dy.CME(C&B), Dy.CME(IEU) for information.

Copy to : Dy.CMEs, All Regions for information and necessary action.

Copy to : AMEs(T) for information and necessary action.

Copy to : All Depot Managers for necessary action.

Copy to : All Maintenance in-charges of Depots for necessary action

The Digital Automatic Tyre Inflators (SetAir-964KP) procured from M/s Instrument Research Associates Pvt. Ltd., are the latest supplies to depots. To enable the field staff to derive maximum benefits from ATI, the details such as the **salient features, instructions, working system, trouble codes and maintenance** are briefly discussed hereunder.

1.00 The salient features of the equipment:

SetAir-964KP model ATI is a micro processor controlled tyre inflator that ensures automatic and accurate inflation/ deflation of tyres in the first attempt without wastage of compressed air. The maximum time from Zero to 80 Psi is about 150 sec. and top up time to inflate a tyre by 6Psi is about 14 seconds.



- Trolley mounted Tyre Inflator Automatic for moving around to desired position.
 - 0 -150 psi pressure range
 - 0.5 psi resolution
 - Inflation and deflation functions with $\pm 0.5\%$ of accuracy
 - Sensor range upto 145 psi/10 bar/10.2 kg/cm²/1000 kpa continuous duty
 - Automatic cut off
 - 1.2 inch height 4 digit LCD display for Set pressure
 - 1.2 inch height 4 digit LCD display for Actual Tyre pressure
 - 3 meters long power cord
 - 15 meters long double braided nylon tubing with nozzle at one end for connecting instrument to tyres with quick connector
 - 3 meters R1 pipe from compressor end to instrument
 - 100V - 265 VAC, Single phase, 50Hz
 - Safety precaution key on 125 psi inflation to be confirmed
 - Power requirements - 25 VA at 230V $\pm 10\%$, 50Hz $\pm 5\%$ single phase AC mains
- **Life time warranted Keys:**
 - a) Increment
 - b) Decrement switches for setting desired pressure
 - c) A flat tyre switch for filling empty tyres
 - d) A change over switch for changing of units either in psi or Kg/cm²
 - e) A ON/OFF switch for backlight
 - Alarm (Buzzer) for Beep signal achieving the set pressure, audible in your workshop environment
 - Auto drain filter to provide clean(moisture less) air to tyre
 - Automatic Fast Filling Speed
 - Complete protection under overload conditions with an Electronic fuse

2.00 The main components of the Automatic tyre Inflator:

1. Central processing unit(CPU Circuit)
2. Display Circuit
 - a) Back-light and Switch
3. Power Supply Unit(PSU)
 - a) Fuse
4. Pneumatic Circuit
 - a)Solid state Pressure sensor
5. Key Pad
 - a) 'INCREMENT' and 'DECREMENT' KEYS
 - b) 'CONFIRM'(a safety feature)/ BACKLIGHT KEY
 - c) CONVERT Key
 - d) 'FLAT TYRE' Key
6. Double Ended Nozzle.

3.00 Operating Principles: (See Fig-1 to Fig-3)

3.01 Auto Fill Function (inflation) :

The pressure upto which a tyre is to be inflated is set on the Set Pressure display using INC/DEC keys on the front panel of Tyre inflator or on the remote switch unit. When the nozzle is pressed firmly against the valve tube of the tyre, first it measures the Actual tyre pressure and computes the difference between set & Actual pressures and sets the filling speed and air starts filling through the solenoid valve operating to a logic worked out by the microprocessor provided the air pressure in the tyre is lower than Set pressure. The solenoid valve completely shuts off air supply when SET PRESSURE and Measured tyre pressure become equal. A beeper beeps after the tyre is inflated to SET PRESSURE.

If air pressure in the receiver of the compressor is maintained at 140 psi/9.6bar/9.8kg/cm² /965kpa, it takes about 24.00+/- secs. To inflate a car tyre size of 155/80 R13 from 0-26 psi [1.8 bar/1.82kg/cm² /180kpa.

3.02 Auto Release Function (Deflation):

If the actual tyre pressure reading at first measurement is found to be higher than the set pressure, the excess air is automatically released, and beeper beeps on reaching SET PRESSURE. There is no set timings for release function as air has to come out of the tyre with the air pressure inside the tyre working as the source pressure.

3.03 Automatic Identification of Type and size of Tyre:

From the SET Pressure reading, the powerful software identifies the likely size of the tyre and adjusts the duration for inflation and cycle depending on the size of the tyres upto LTV tyres (Small Volume Tyres) one logic works. Because of the auto identification circuit, time taken to fill even HTV tyre is minimal and also safety is ensured as the filling speeds are different for different tyre sizes.

3.04 Automatic Setting of Filling Speed :(Slope)

On first measurement of the actual tyre pressure, the software compares the ACTUAL tyre pressure reading with the SET pressure and establishes the difference in pressure and accordingly sets filling speed. If difference between two pressures is higher, then higher filling speed is set. However, in both the cases last 10% is filled slowly to get high accuracy. During auto release cycle, speed of release is dependent on pressure inside the tyre and therefore is independent of the difference in pressure.

4.00 Air Inlet/Outlet Connections & Power Connections”(See Figs.2&3)

4.01 Connect air supply line from compressor/source of air or Nitrogen to the port marked `AIR INLET`. This port can be seen at the bottom recess of the equipment. The hose pipe should be pushed on to the brass connector and use the brass nut provided to tightened inlet hose pipe on to the air inlet to avoid air leakage. If air leakage exists, the inflation function will not be effective. Use Teflon tape (75 micron thick) to seal the leaks, see clause no. 10.5.6 also. Use braided PVC hose pipe of 6.3 mm ID and 12 mm OD rated for at least 30 bar (435psi) rupture pressure.

The source of air can be Inflation bays communicated vide letter no:TR1/815(9)/2008-MED, dtd. 27.03.2008. The air source can also be developed at any appropriate point of parking place itself. The system is more useful where the vehicle movement is a constraint in the garage. For operating the ATI at such remote points, a power point is to be ensured.

4.02 Ensure that the maximum compressor pressure is within 145 psi/10 bar/10.2 kg/cm²/1000 kpa. Lower pressure will result in larger filling time. Lowest pressure acceptable for proper operation is 116 psi/8bar/8.2 kg/cm²/800 kpa.

4.03 If source pressure is more than 145 psi/ 10bar / 10.2 kg/cm² / 1000 kpa. use a filter regulator and set the regulator at 145 psi/ 10bar / 10.2 kg/cm² / 1000 kpa. Interpose the filter regulator as shown in Fig.11. Install anywhere on the air line connecting compressor to Tyre Inflator.

4.04 Connect one end of the air outlet hose pipe to the outlet marked as “AIR FILLING” seen at bottom recess of the equipment, by ensuring that air nozzle is fitted at the other end of the hose pipe. This is used for inflating the tyre or release of excess air. Use the brass nut provided to tighten the hose pipe on to the air outlet to avoid leakage.

4.05 Use braided PVC hose pipe of 6.3mm ID and 12mm OD rated for at least 30 bar rupture pressure. Use Teflon tape (75 micron thick) to seal the leaks. See clause 10.5.6 also.

4.06 Replacement of Hose Pipe and avoiding the Air Leakage:

For maintenance purpose or for changing the hosepipe, to may be required to disconnect the hosepipe at the instrument end. While reconnecting them back to the instrument please ensure that the hosepipe has diameter exactly as per what is used on the instrument (ID = 6.3 mm, OD = 12mm). This will press fit on to the brass connector such that there is no air leak. If there is any air leak on the brass connector at the instrument end, use thin Teflon tape of 75 Microns thickness and wind it in the opposite direction to the threading so that the Teflon tape will not get unwound while the brass connectors are tightened.

5.00 Operation :

5.01 Air Filling/Release Sequence (Inflation/Deflation)

- I. Use the Increment and decrement keys provided on the unit to set the required tyre Pressure. Remote unit can also be used to set the tyre Pressure.
- II. Press “INC (▲)” Key to increment the SET PRESSURE upto 150 psi / 10.5 KG/CM²/10.3 BAR/1030 kpa. If this key is pressed continuously for more than 2 sec, FAST INCREMENT operation gets activated and reading is indicated on the SET PRESSURE display. The Maximum limit upto which the inflation level could be set is upto 150 psi / 10.5 KG/CM²/10.3 BAR/1030 kpa. Above this value, the SET PRESSURE display will not change and stops at this position.
- III. Press ▼ key to Decrement the SET PRESSURE upto 3 psi/0.2 bar/0.2 kg/cm²/20 kpa. It this key is pressed continuously for more than 2 sec FAST DEC operation gets activated and reading is indicated by the SET PRESSURE display. The Minimum limit up to which the inflation level could be set is 3 psi / 0.2 bar . 0.2 kg/cm² /20 kpa. Below this value, the SET PRESSURE will not change and stops at this position.
- IV. Hold the TYRE INFLATING nozzle on to the valve tube of the tyre tightly after ensuring the desired pressure has been set on the display. Ensure there is no leak from the nozzle for proper fill and release functions. Where many different tyres of vehicles have to be serviced, and only topping up of air is required, double ended nozzle (non-latching) is ideal for quick change and can be held pressed against the valve tube by ensuring that air does not leak as the time required for top-up or release is very short. Also, clip on nozzle could be used if inflating large volume tubes is regular function.
- V. The unit first identifies the size of the tyre automatically and selects the auto fill duration and cycle time automatically.
- VI. It measures the difference between Set and Actual pressure and sets the filling speed automatically. (release speed is dependent on the pressure inside the tyre).
- VII. Continues the fill/release and measure sequence automatically.

- VIII. If the TYRE PRESSURE is lower than the SET PRESSURE, the TYRE INFLATOR starts filling the air into the tyre and the TYRE PRESSURE display updates, When the TYRE PRESSURE equals the SET PRESSURE the BUZZER beeps indicating that the tyre has been filled to the SET PRESSURE and the air supply is cut-off. Remove the filling nozzle from the valve tube of the tyre.
- IX. If the TYRE PRESSURE is already more than the SET PRESSURE, the TYRE INFLATOR releases air from the tyre to reduce tyre pressure. When the TYRE PRESSURE equals SET PRESSURE, BUZZER beeps.
- X. If the equipment is not in use for more than 5 minutes (i.e when the filling nozzle is kept open without connection to the tyre) then the set pressure display starts flashing, demanding confirmation of set pressure for filling/releasing operation.
- XI. This feature ensures usage of the equipment with the proper pressure to the tyre being inflated. In other words, avoids inflating a tyre with previously set value which may be wrong.
- XII. For Set pressure more than 125 psi/3. bar /3.5 kg/cm²/340 kpa CONFIRM key is to be pressed.
- XIII. Over-inflate and then deflate function if equipped will function automatically.

6.00 Safety Features:

6.01 Absolute safety to avoid tyre bursts:

In the event of User attempts to inflate a tyre with set pressure of 125 psi/ 8.8 kg/cm² then on identifying the difference between the measured tyre pressure and set pressure in the first cycle, equipment will identify the size of the Tyre and inhibits inflation. The 'set pressure' display will start flashing and simultaneously the buzzer beeps an alarm. Now to proceed further the user will have to reduce the 'Set Pressure' or press the 'CONFIRM' key if pressure more than 125 psi/8.8 kg/cm² is needed, (he will do so at his risk).

6.02 Fail Safe Mode Offered by third safety solenoid:

In the unlikely event of microprocessor losing control due to corruption/loss of programmed data during power interruption, the equipment shuts off the solenoid valve after a few milli secs. Therefore no further filling takes place. Similarly, if the inflating solenoid fails, then to protect the tyre & the operator against tyre bursts, the third solenoid is activated to shut-off the input air supply automatically.

6.03 NO Chance for Over Inflation:

Microprocessor senses the tyre pressure and cuts off air supply even if air nozzle is held pressed on valve tube for a long time after completion of inflation thereby leaving no possibility of over-inflation ensuring safety to the operator and to the tyres.

6.04 Demands Confirmation of Set Pressure after 5 mts. Idle Time:

If the equipment is not in use for more than 5 minutes(i.e. when the filling nozzle is kept open without connection to the tyre) then the set pressure display starts flashing, demanding conformation of set pressure for filling/releasing operation. This feature ensures usage of the equipment with the proper pressure to the tyre being inflated. In other words, the equipment avoids inflating a tyre with previously set valve which may be wrong.

6.05 Seeks conformation of Set Pressure More than 125 psi:

To over come negligence of the operators and users in setting desired pressure which may result in fatal tyre bursts, the equipment demands confirmation of set pressures which are in excess of 125 psi.

6.06 Watch-dog Circuit:

A Watch-dog circuit monitors all the electronic circuits, microcontroller itself, sensor and solenoids in every cycle. Error codes [dtc1 to dtc12] are displayed and equipment inhibits operation.

6.07 Allows Time for Stabilization:

After reaching the desired valve, allows sufficient time for the pressure to stabilize in the tyre and any small error is corrected automatically by filling again and finally it will give 'Inflation/Deflation complete" indication by beeping and cuts off the air supply.

6.08 Air leak Detector/Detection Of Puncture In Tube Or Tyre:

In spite of all the precautions taken to avoid air leakage, if air leakage still persists, then the "air leak" detection feature of the tyre Inflator comes into picture and inhibits further air loss by closing the solenoid valve on the air inlet line. The same feature is also useful for detecting the "puncture" in the tubes and tyres. To prevent further air loss, as soon as recognizable puncture(those not resulting in only micro leaks) is detected it will inhibit air supply by closing solenoid valve and Diagnostics Trouble Code 5 (dtc-5) is displayed.

7.00 Error Codes and Maintenance :

7.01 The equipment is equipped with in-built diagnostic program which diagnoses the faults within the equipment and those external to it such as low/high compressor pressure and power supply variation and displays the corresponding error codes. The error is indicated as `dtc' [Diagnostic Trouble Code] on the "Set Pressure" display LCD and the corresponding error code number is displayed on the "Tyre Pressure" display LCD. These codes help the service engineer to quickly recognize the faults and attend to fix the faults.

The following are the 'dtc' codes indicating the nature of fault:

7.02 Diagnostic Trouble Codes :

	Code	Nature of fault
a	dtc1	Pressure sensor failure: When the Pressure Sensor output is shorted to power supply or ground, this code is displayed and the equipment suspends filling/release operation. To set right the fault, replace the pressure sensor and press any of 3 keys - 'INC', 'DEC', or 'CONVERT' to reset the Tyre Inflator.
b	dtc 2	CPU board failure: When the CPU board is not working, this error code is displayed. Replace the CPU board and press any of 3 keys - 'INC', 'DEC', or 'CONVERT' to reset the Tyre Inflator
c	dtc 3	Low compressor/source pressure: For normal functioning of the equipment, the minimum compressor pressure should be 14.2 psi/0.98 bar/1kg/cm ² /98 kpa more than the set pressure e.g: if the set pressure is 26 psi/1.8 bar/1.8 kg/cm ² /180 kpa, the compressor pressure should be more than or equal to 40.2 psi(26+14.2) 2.8 bar/ 2.8 kg/cm ² /280 kpa. Otherwise the equipment displays this code and the operation is suspended. To set right fault, allow the compressor pressure to build-up to the required level and press any of 3 keys - 'INC', 'DEC', or 'CONVERT' to reset the Tyre Inflator
d	dtc 4	High compressor pressure: Compressor pressure should not exceed 160 psi/ 11.25 kg/cm ² / 11 bar/ 1100 kpa, for normal operation. If it exceeds 160 psi/ 11.25 kg/cm ² / 11 bar/ 1100 kpa, this error code is displayed and operation of the equipment is suspended. To resume the normal operation, reduce the compressor pressure to below 160 psi/ 11.25 kg/cm ² / 11 bar/ 1100 kpa and press any of 3 keys - 'INC', 'DEC', or 'CONVERT' to reset the Tyre Inflator
e	dtc 5	Air leak: This code is displayed when air leak is detected in filling nozzle, hose pipe, sensor or solenoid. This code is also displayed if there is puncture in the tyre/tube while inflation process is on. Whenever this code is displayed, check for air leaks at the above points, arrest the air leaks and press any of 3 keys - 'INC', 'DEC', or 'CONVERT' to resume the operation.
f	dtc 6	Low Supply Voltage for Solenoid (+24VDC): For normal functioning of the equipment, supply voltage (+24VDC) should not fall below 20V. If the supply voltage is below 20V, this code is displayed. Replace the power supply card. Press any of 3 keys - 'INC', 'DEC', or 'CONVERT' to reset the Tyre Inflator for normal operation.
g	dtc 7	High Supply Voltage for Solenoid(+24VDC): For normal functioning of the equipment, supply voltage (+24VDC) should not exceed 28V. If the supply voltage exceeds 28V, this code is displayed, replace the power supply card. Press any of 3 keys - 'INC', 'DEC', or 'CONVERT' to reset the Tyre Inflator for normal operation.
h	dtc 8	Inflation(Filling) Solenoid Failure: On getting the command to inflate, if the inflation solenoid doesn't send the feed back to the CPU confirming its operation then "dtc8" code is displayed. Check the coil resistance of the solenoid valve for permissible limits [75 to 100Ω]. If it is found to be out of the limit, replace the solenoid. press any of 3 keys - 'INC', 'DEC', or 'CONVERT' to reset the Tyre Inflator for normal operation.

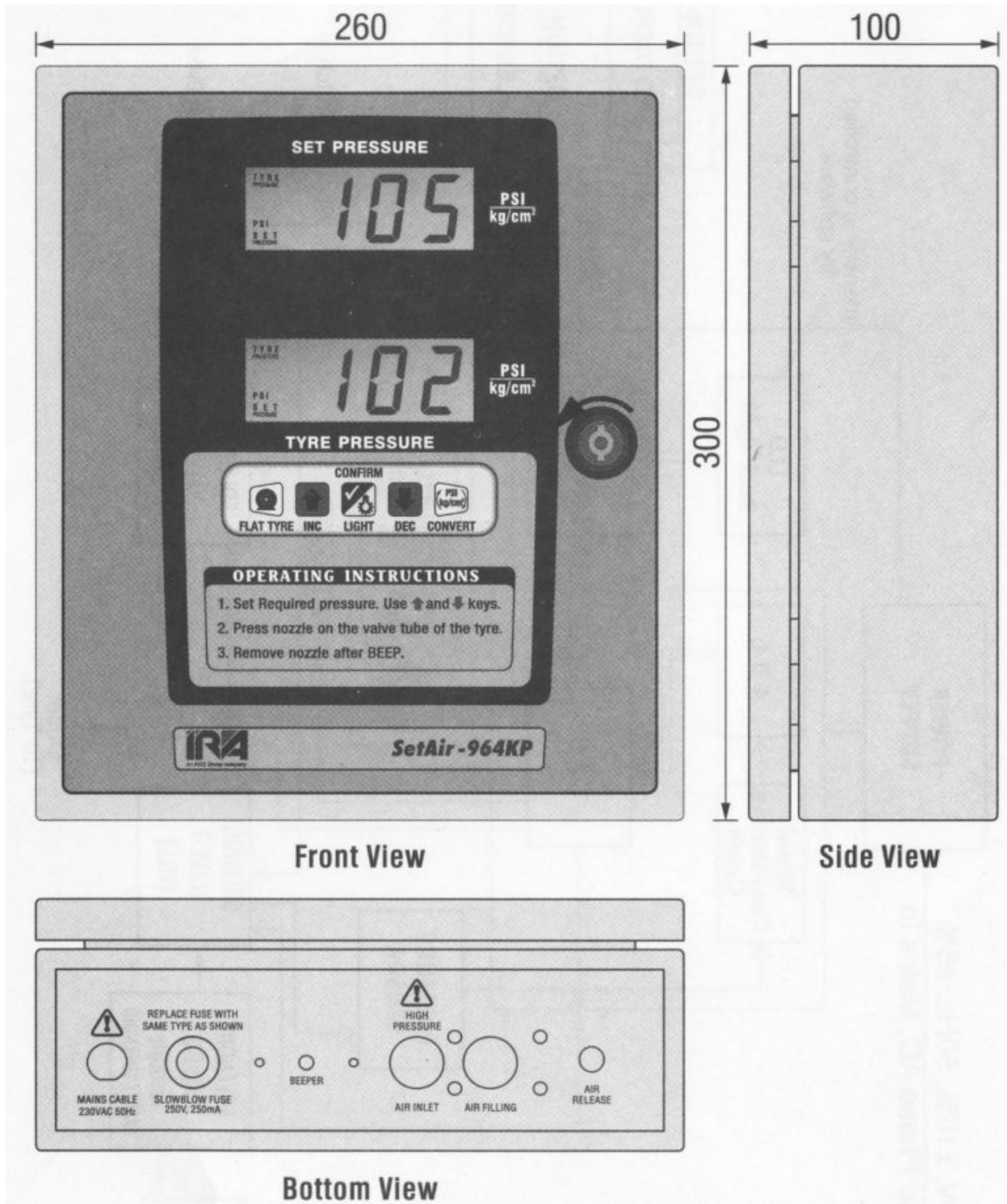
	Code	Nature of fault
i	dtc 9	Deflection(Releasing)Solenoid failure: On getting the command to deflate, if the deflating solenoid doesn't send the feed back to the CPU confirming its operation then "dtc9" code is displayed. Check the coil resistance of the solenoid valve for permissible limits [75 to 100Ω]. If it is found to be out of the limit, replace the solenoid. Press any one of 3 keys - 'INC', 'DEC', or 'CONVERT' to reset the Tyre Inflator for normal operation.
j	dtc 10	Supply Voltage for Amplifier and Sensor (+12 V) Out of range: This code is displayed when +12 V supply is out of range. The higher and lower limits of power supply voltage are 11.8 V to 12.2 V. When this code is displayed, replace the power supply card. Press any of 3 keys - 'INC', 'DEC', or 'CONVERT' to reset the Tyre Inflator for normal operation.
k	dtc 11	Supply Voltage for Logic circuits (+5 V) Out of range: This code is displayed when +5 V supply is out of range. The higher and lower limits of power supply voltage are 4.8 V to 5.2 V. When this code is displayed, replace the power supply card. Press any of 3 keys - 'INC', 'DEC', or 'CONVERT' to reset the Tyre Inflator for normal operation.
l	dtc 12	Absolute Safety Solenoid Failure: On getting the command to operate, if the safety solenoid doesn't send the feed back to the CPU confirming its operation then "dtc12" code is displayed. Check the coil resistance of the solenoid valve for permissible limits[75 to 100Ω]. If it is found to be out of limits, replace the solenoid. Press any of 3 keys - 'INC', 'DEC', or 'CONVERT' to reset the Tyre Inflator for normal operation.

8.00 Calibration of the instrument: The equipment shall be calibrated once in a year. The calibration particulars shall be recorded in the Log book. For the purpose of calibration check, the ATI is to be checked with Master gauge which is to be kept in Tyre section for that purpose only. The existing standardized digital inflating gauge can be used as the Master gauge. In no case Automatic Tyre Inflator shall not be taken as Master gauge.

9.00 Every unit supplied by the firm is provided "Maintenance and Operating instruction Manual" from which the above details have been extracted. It is necessary go through the Manual before installation and for any problem during the course of operation. For any further technical assistance on the problems with Automatic Tyre Inflator, it is advised to contact Mr. M.Srinivasa rao, Mobile No: 09346274903, under intimation to Dy.CME of the Region, the Address of the above person is:

Service Engineer/ IRA details:
M.Srinivasa rao
H.NO: 8-35, Road No:1,
Vidhyuth nagar,
Dilshuiknagar, Hyderabad - 500 060.
Cell: 09346274903.
Fax No:040-24049091.

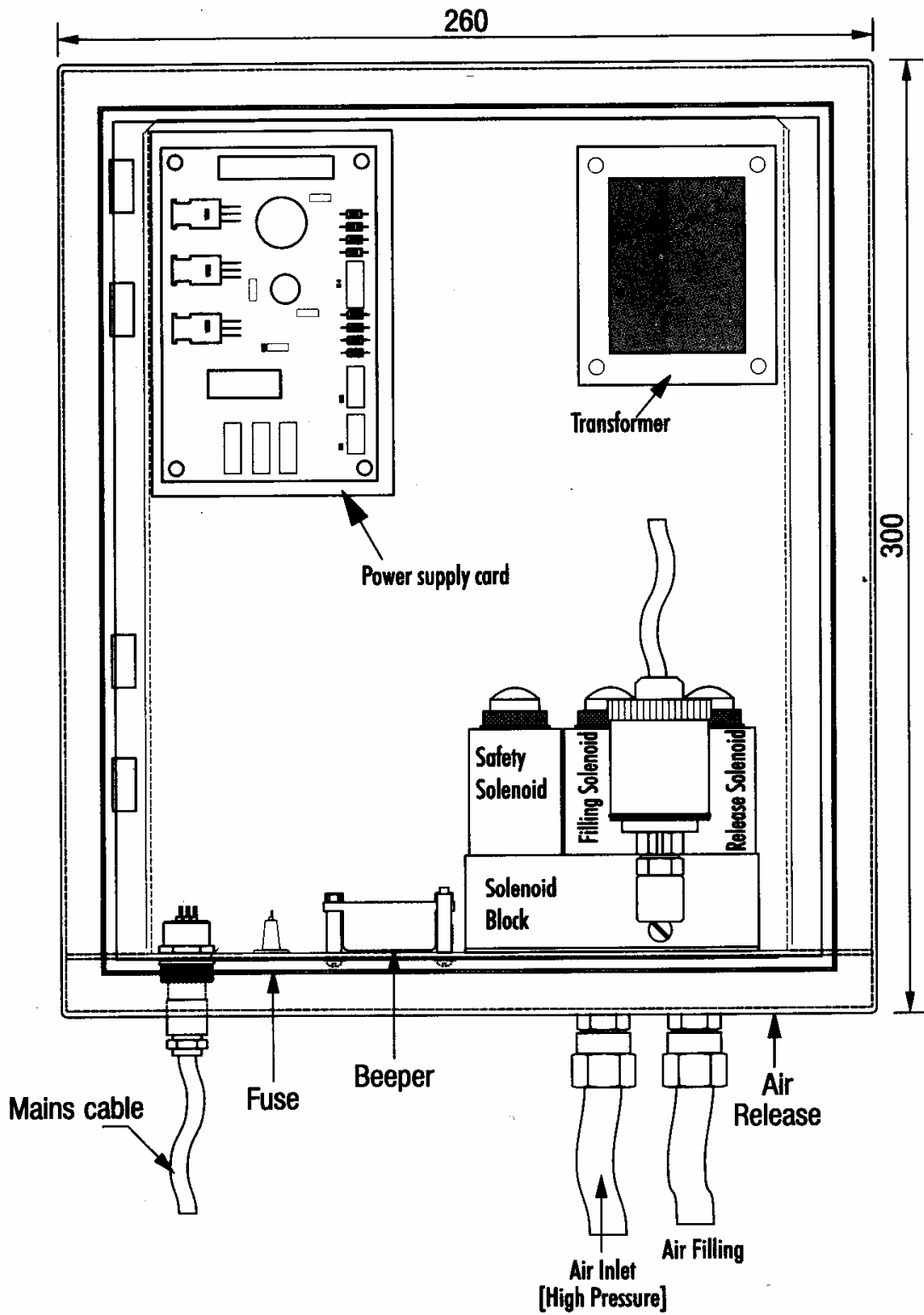
A View of Tyre Inflator with 2 LCD Displays



TYRE INFLATOR – “SetAir-964KP”

Figure-2

A View of internal Assembly of Tyre Inflator showing Air Inlet/Outlet and Electrical Connection Details



A View of Installation details of Tyre Inflator to the Trolley

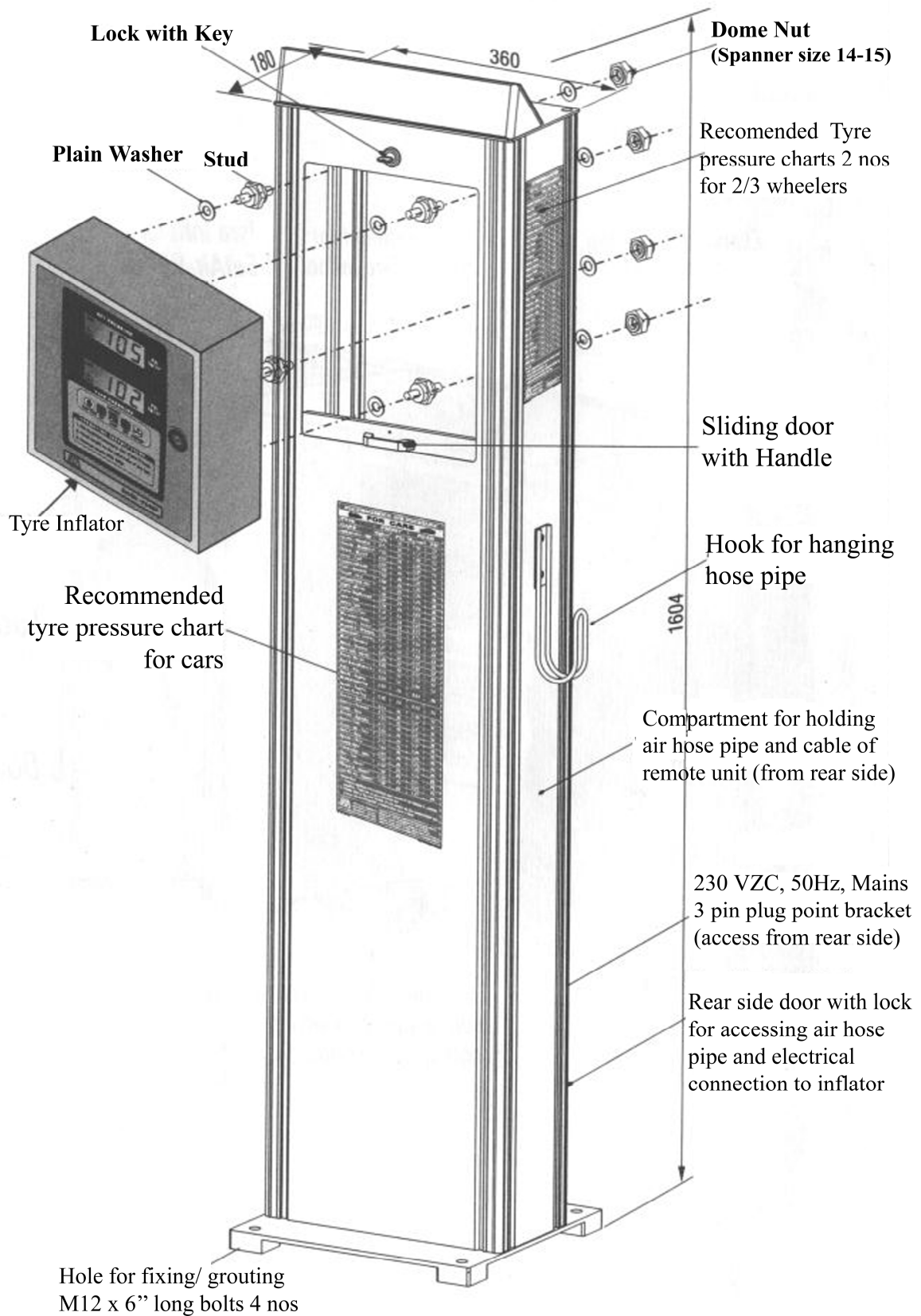


Figure-4

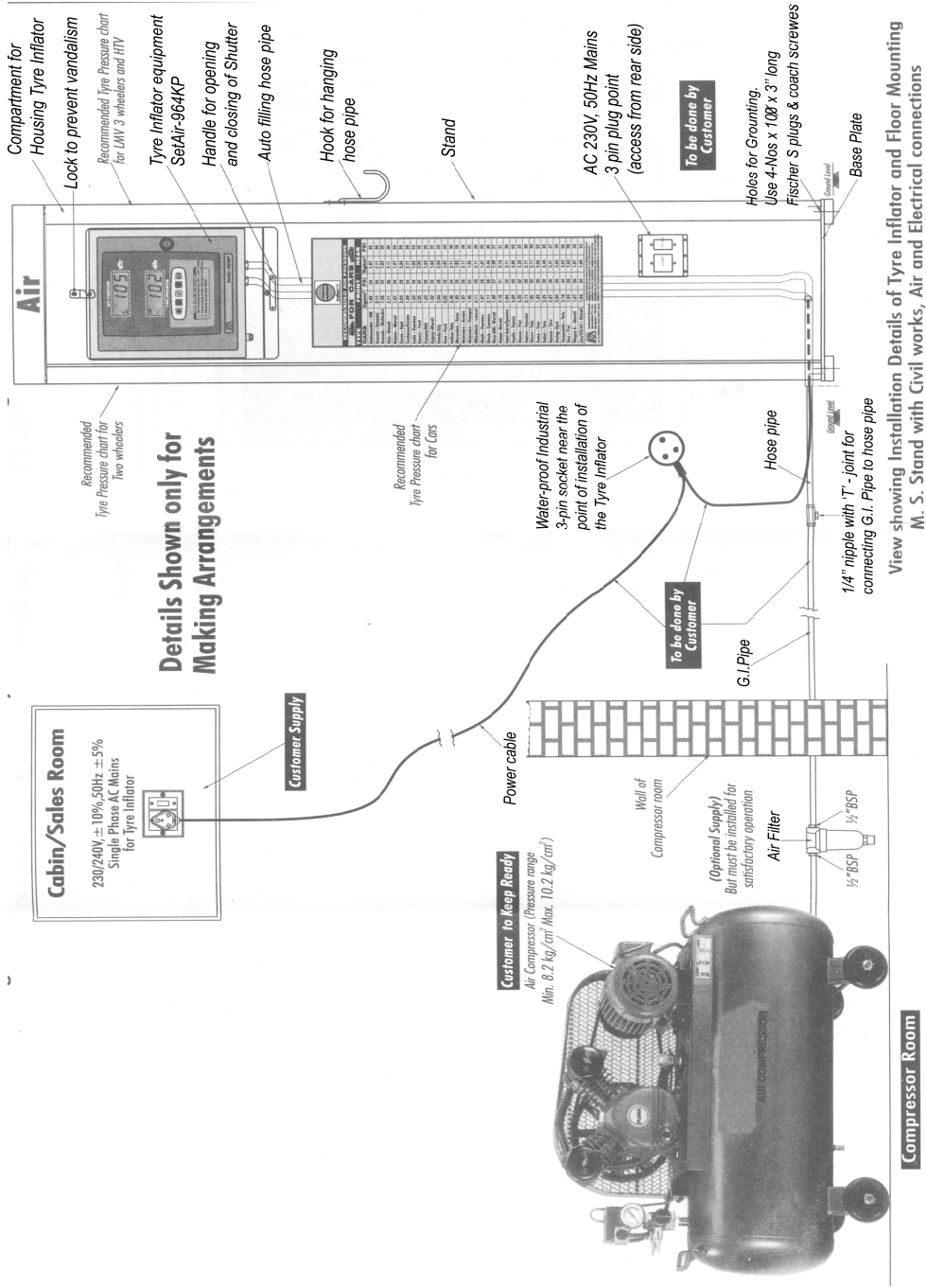


Figure-5

