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PIPER RETS **Railcar Engine Test System**

Introduction

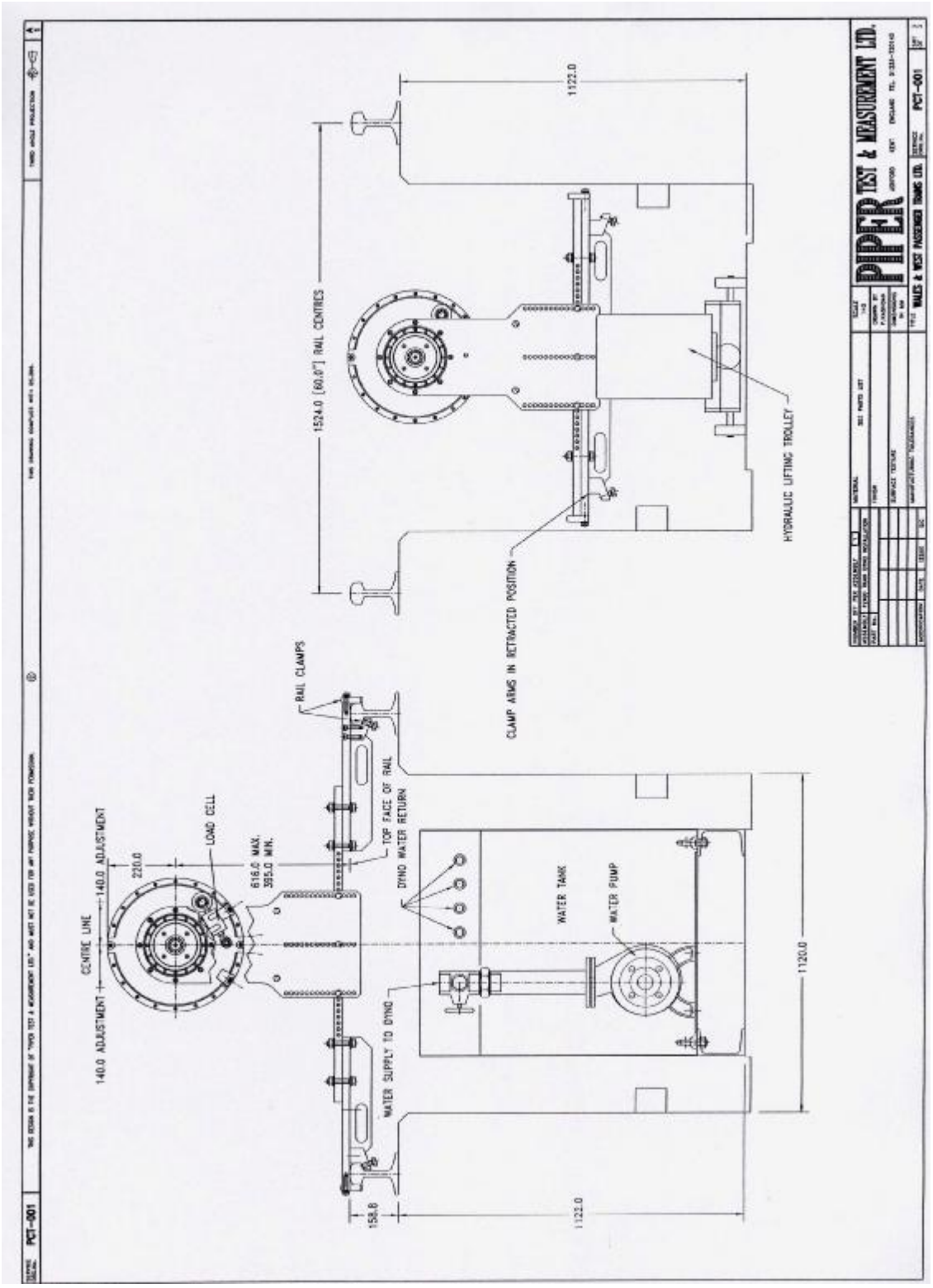
The PIPER P2400 dynamometer based Railcar Engine Test System is suitable for the "In Chassis" testing of a range of diesel engines including those fitted to the Class 14X, Sprinter150, 153, 155, 156, 158,and 159 railcars.
It enables operators to fault-find or undertake diagnostic work without removing the engine and or gearbox from the chassis while the engine is under load. To undertake such work, at present, the railcar has to be taken
"On-Route" to simulate operating conditions and even then it is difficult for the testers to fully load the railcar. The adjustibility of the support frame allows the dynamometer to be fitted between the gearbox output flange and railcar differential pinion input flange.
In most instances no auxiliary equipment needs to be removed from the railcar, only the gearbox/ differential cardan shaft.
A speed sensor and sender is fitted to the cardan shaft connecting the engine and gearbox which enables the monitoring of engine speed while the gearbox output speed is measured by a magnetic pick up and sender unit fitted to the dynamometer.
The measuring of these two speeds enables operators to monitor gearbox ratios and gearbox efficiencies.

The dynamometer assembly is mounted on the hydraulic support trolley and retained by a couple of clevis pins. The dynamometer, complete with the trolley is placed on the floor of a service pit in the garage. The vertical end-plates attached to the dynamometer are height adjustable so that the dynamometer can be placed at the same height as the cardan shaft centre line height for easy connection to the gearbox output flange. The whole assembly is raised or lowered by means of a hydraulic trolley. When the horizontal connecting plate is at a height just above the rail, the horizontal slider plates are extended outwards and bolted to the rails. The slider plates are retractable so that the whole assembly can be lowered into the pit when not in use. The water supply is connected from the tank and the supply pump via the mechanical load control valve to the dynamometer inlet ports. Increasing water flow increases the load the dynamometer exerts on the engine and vice versa.

Test system components

The rail car test system was designed to enable the testing of diesel powered rail cars engines while fitted in their chassis. The basic system comprises the following major components.

1. PIPER P2400 dynamometer is mounted in double trunnions fixed to two vertical end support plates. The end support plates are connected to a horizontal connecting plate complete with two slider plates for bolting to the rail.
2. A hydraulic support trolley for lifting the above assembly.
3. PIPER P15EDA computer based data logging system or any other instrument from the PIPER range of instrumentation.
4. Voith output adapter suitable for connection to the dynamometer cardan shaft.
5. Dynamometer water system including supply pump.



P2400R **General Arrangement Drawing**

Installation procedure.

1. Place the dynamometer assembly complete with the hydraulic trolley on the service pit floor approximately where you intend to test the railcar i.e. where the gearbox / differential cardan shaft is located.
2. Situate the water tank assembly behind the dynamometer on the service pit floor.
3. Connect the dynamometer supply pump to the mechanical load control valve.
4. Drive the railcar into position so that the dynamometer is placed below the gearbox / differential cardan shaft of the engine to be tested. Apply the railcar brake.
5. Remove the gearbox/ differential cardan shaft.
6. Raise the dynamometer by means of the hydraulic trolley until the slider plates can be extended to rest on top of the rails. Bolt the slider plate to the rails and lock the slider plate to the horizontal connecting plate.
7. If the dynamometer needs to be raised or lowered once the slider plate is bolted to the rail, remove the six bolts (3 each side) retaining the vertical end support plates to the horizontal connecting plates.
8. Raise or lower the dynamometer until the dynamometer centre line is horizontally in line with the gearbox output flange centre line.
9. Ensure that the dynamometer is situated centrally between the gearbox and differential output and input flanges.
10. Replace the 6 retaining bolts connecting the vertical plate to the horizontal connecting plate.
11. Connect the gearbox output flange to the Voith adapter plate.
12. Connect the PIPER supplied cardan shaft to the dynamometer and adapter plate.
13. Check all mounting and securing bolts and nuts for tightness.
14. Connect the water supply from the fitting adjacent to the pressure gauge on the water tank to the mechanical seal connector situated below the dynamometer.
15. Connect the two hoses for the water supply from the mechanical load control valve to the two dynamometer inlet ports.
16. Connect the dynamometer water return hoses to the tank. Note it is important that the water can return freely to the tank so that no water can be retained in the dynamometer or the hoses when the load is removed.
17. Connect the seal feed return from below the dynamometer to the tank.
18. Connect one RPM and one torque/ overheat sensor cable to the dynamometer from the PIPER instrument.
19. Connect all the engine monitoring temperature cables, thermocouples and pressure hoses to the engine from the P15 EDA. If any other PIPER instrument is specified connect accordingly.
20. Open water pump by-pass valve fully and switch on pump.
21. Open mechanical load control valve and check that water returns freely from both rotor outlet ports and the mechanical seal.
22. With the load valve fully open, close the by - pass valve until a pressure of 4 Bar is showing on the pressure gauge.
    NOTE: This pressure may need to be adjusted to suit individual testing requirements.
23. Close the mechanical load control valve and the engine is now ready for starting. Irrespective if a load is applied or not the water feed to the mechanical seals must be retained at all times the dynamometer is rotating.
24. Idle the engine to ensure that the assembly is stable and rotating without major vibrations.
25. Gradually increase speed and load.
26. Monitoring parameters should now be available on the instrument.

P15 EDA **instrumentation**

ENGINE RPM CONNECTOR

4 TEMPERATURE CHANNELS

FUSED ON/OFF SWITCH

DYNO RPM CONNECTOR

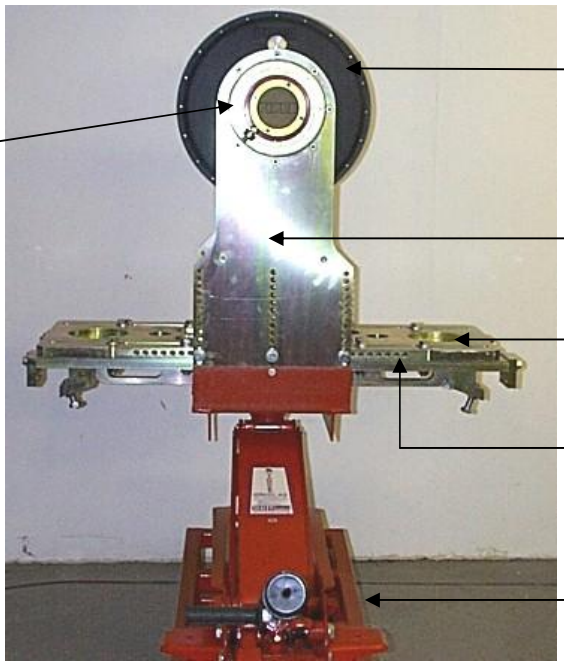
DYNO TORQUE & OVERHEAT CONNECTOR

8 PRESSURE CHANNELS

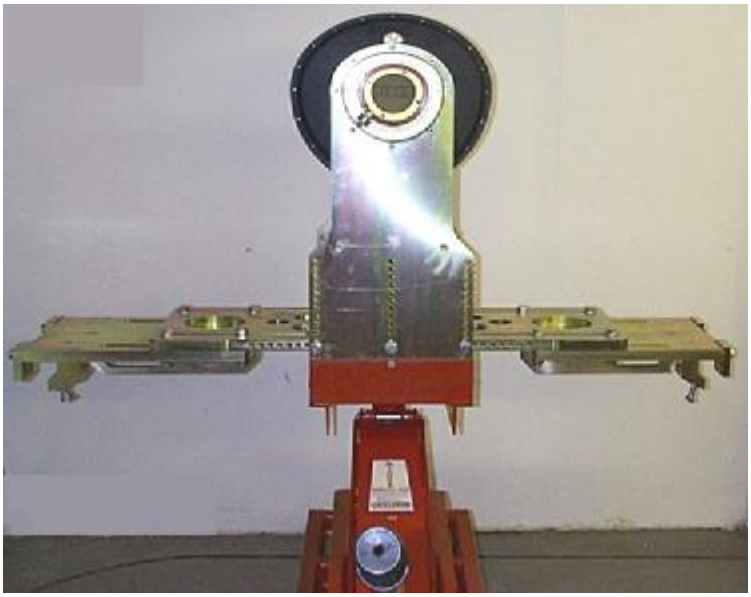
RS485/232 CONNECTOR

3 PIN THREADED CHASSI S PLUG FOR 240V AC INPUT

General Assembly

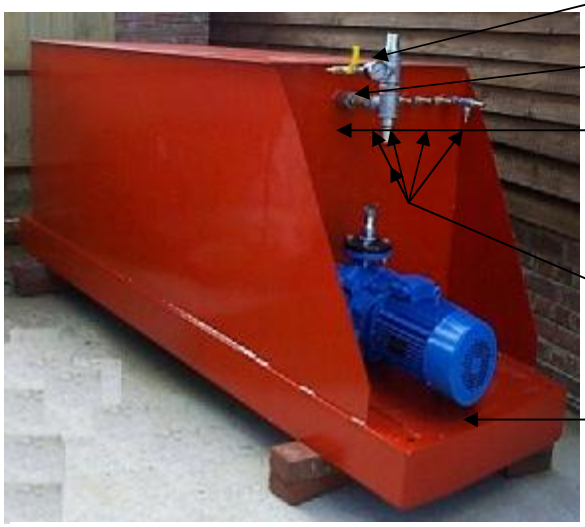


RAILCAR TEST SYSTEM WITH SLIDER PLATES RETRACTED

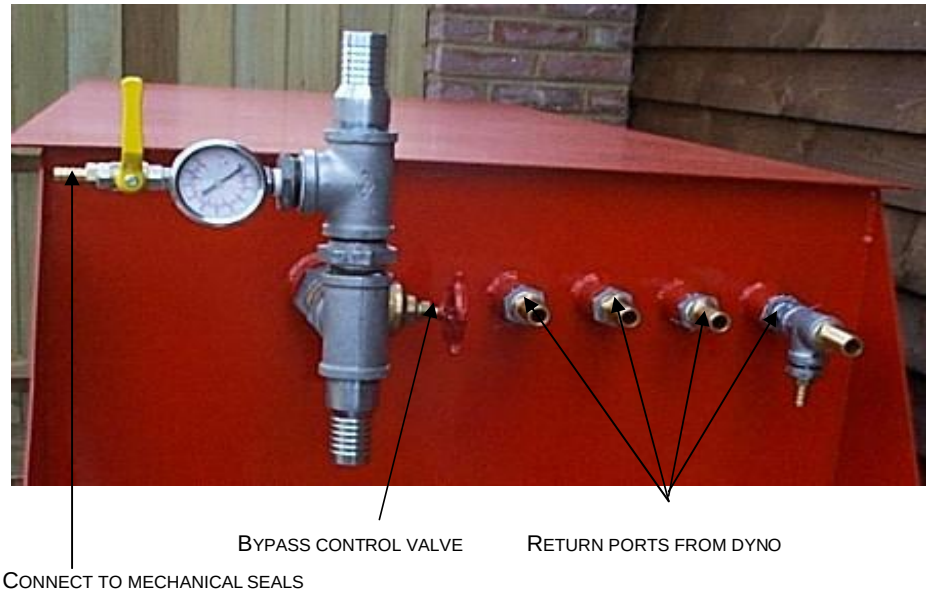


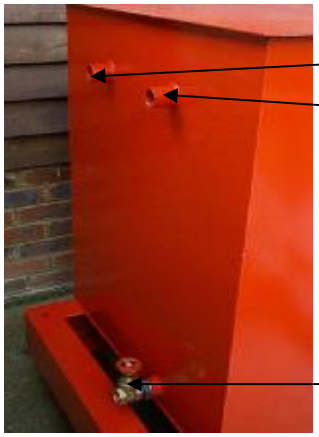
RAILCAR TEST SYSTEM WITH SLIDER PLATES EXTENDED

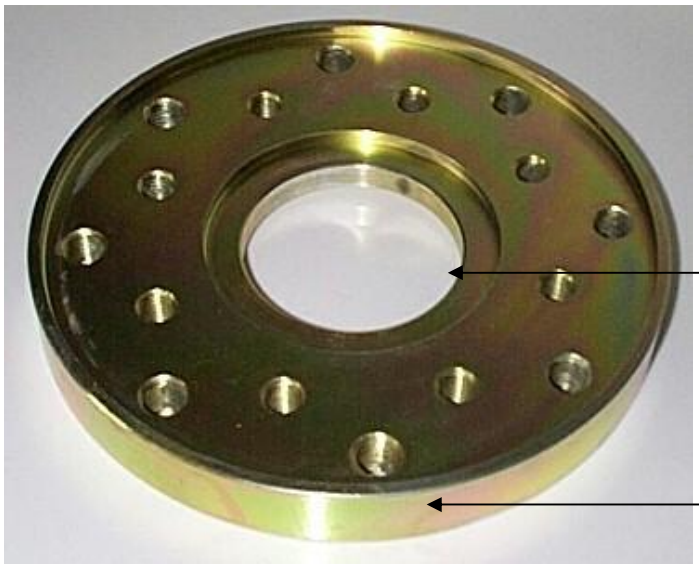
Water Tank



DYNAMOMETER MAIN WATER RESERVOIR, INCLUDING SUPPLY PUMP, BYPASS VALVE AND PRESSURE GAUGE.





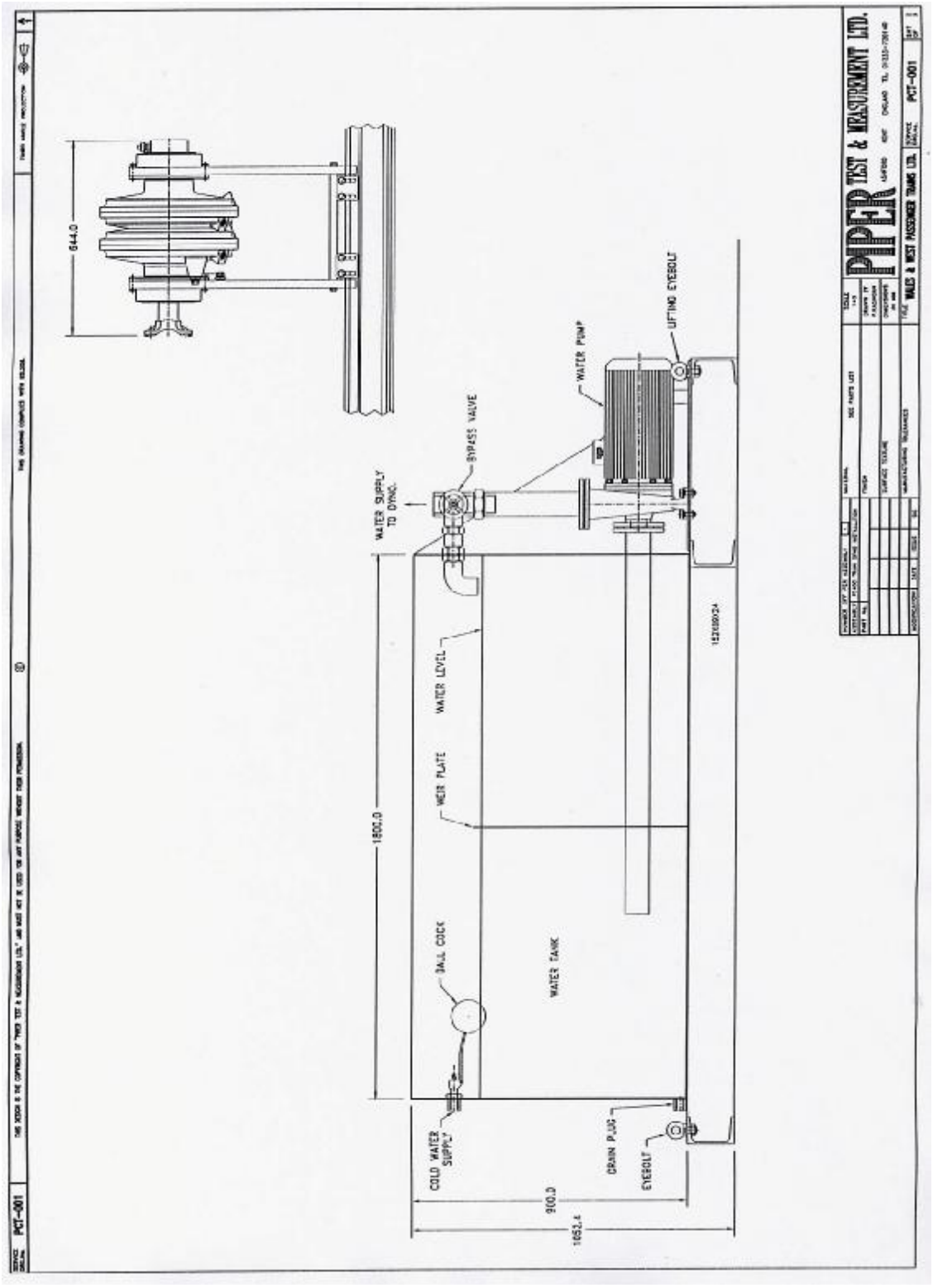


Voith Transmission Adaptor Flange

Suitable for bolting to Voith transmission with 180 and 225 output flanges. External protrusion for 225 location. Internal recess for 180 location.
Drilled and tapped to accept dynamometer connecting cardan shaft.

Engine RPM sensor and sender

Magnetic inductive pick up sensor mounted on engine/gearbox cardan shaft "safety bracket". 2 part sender clamped by two jubilee clips onto cardan shaft creating 4 pulses per revolution. Sender diameter sizes are available for 95 mm, 100 mm and 140 mm diameter cardan shafts.



Water tank assembly

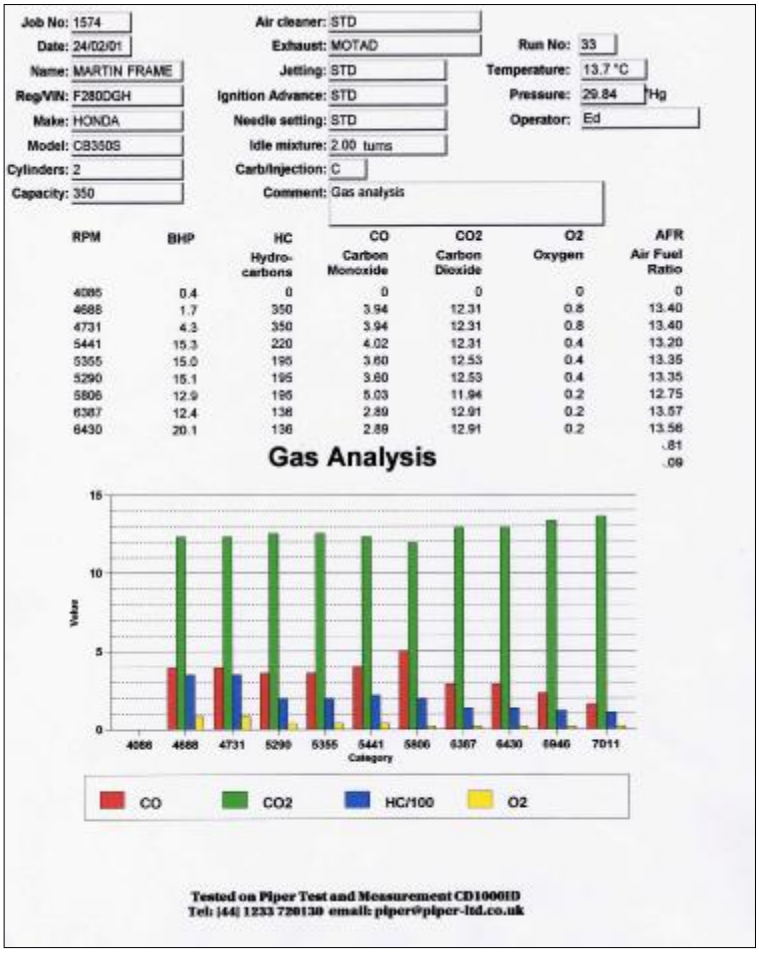
Emission Analysis

MGA 1500

The modular analyser is a modern gas analyser ready for the future. The unit is designed to meet all European standards. Standard measurements include four gasses (CO, CO2, HC, O2), oil temperature, Lambda (ë) and has a clock-calendar feature. The measurements are displayed on six, very bright, twenty millimeter LED display elements. A print-out result is possible with the standard thermal printer included. It also comes with a RS232 connection, which offers the possibility of interfacing with other equipment.

SIMPLE CONTROLS

The controls are simple to operate and consist of a thumbwheel, right/left arrow key, function, print and mode/cancel buttons, allowing easy navigation through the MGA 1500 software.



Job No: 1574 | Air cleaner: STD
Date: 24/02/01 | Exhaust: MOTAD | Run No: 33
Name: MARTIN FRAME | Jetting: STD | Temperature: 13.7 °C
Reg/VIN: F280DGH | Ignition Advance: STD | Pressure: 29.84 "Hg
Make: HONDA | Needle setting: STD | Operator: Ed
Model: CB350S | Idle mixture: 2.00 turns
Cylinders: 2 | Carb/Injection: C
Capacity: 350 | Comment: Gas analysis

RPM	BHP	HC Hydro-carbons	CO Carbon Monoxide	CO2 Carbon Dioxide	O2 Oxygen	AFR Air Fuel Ratio
4086	0.4	0	0	0	0	0
4688	1.7	350	3.94	12.31	0.8	13.40
4731	4.3	350	3.94	12.31	0.8	13.40
5441	15.3	220	4.02	12.31	0.4	13.20
5355	15.0	195	3.60	12.53	0.4	13.35
5290	15.1	195	3.60	12.53	0.4	13.35
5806	12.9	195	5.03	11.94	0.2	12.75
6367	12.4	138	2.89	12.91	0.2	13.57
6430	20.1	136	2.89	12.91	0.2	13.56
						.81
						.09

Gas Analysis

Tested on Piper Test and Measurement CD1000ID
Tel: [44] 1233 720130 email: piper@piper-ltd.co.uk

Example of Gas Analysis Report