

Hi H1

This article is a true description of an AECS technical help desk problem and how it was solved.

Vehicle

2008 Hyundai H1 Common rail Turbo Diesel van.

Problem presented to the Helpdesk

This van has had its sump holed by hitting a rock or something, spilling almost all of its engine oil. The engine has been replaced by an engine from a 2012 identical H1 van, which was damaged in an accident. The engines appeared to be identical so were most of the sensors and actuators. There were many problems getting the van to go, it got going by swapping all the engine's sensor and actuators.

The engine is accelerating fine when you take it slow but bogs down when you accelerate fully. After it bogging down it goes into limp home mode and only drives very slowly.

Every time the engine goes into limp home a fault code is set: "rail pressure too low". The vehicle has been to a number of garages and specialists before it came to us. It has been off the road for 4 months. We cannot put our finger on the problem, can you please assist?

Technical support help desk.

The garage that had the problem vehicle has technical support from AECS as part of an equipment purchase package.

Since the garage only bought a Launch scan tool we tried to test as much as we could but we had to give up as a number of oscilloscope recordings were needed.

In this case, we mutually decided to have the vehicle transported to AECS in Hastings, rather than send this vehicle to an ATS scope owner in the same area, as we normally would do.

Where to start?

As in almost all cases with common rail Diesel, the most important tell tales is the rail pressure and the injector pattern. However in this case the engine was running well, it was only the rail pressure fault followed by the limp home that was trouble.

We decided to start with a scan tool recording.

System knowledge

Knowledge of the system is vital before you can do any diagnostics. The rail pressure in this Hyundai Bosch CP3 system is achieved by a gear lift pump inside the high-pressure pump, which draws fuel from the tank and pushes the fuel through a Suction Control Valve (SCV) into the high-pressure pump.

The high-pressure pump pumps into the fuel rail, which has the injector tubes and a pressure sensor connected to it. Also connected to the end of the fuel rail is a Pressure Discharge Valve (PDV).

The SCV controls the pressure in the rail by allowing Diesel fuel into the pump. Allowing more Diesel into the pump than what is used will increase the pressure and vice versa.

AIR CONDITIONING

Super Special

\$5,995
(+gst)



ECK 790-UP

Automatic single-gas station for recovering,
recycling and recharging R134a refrigerant.

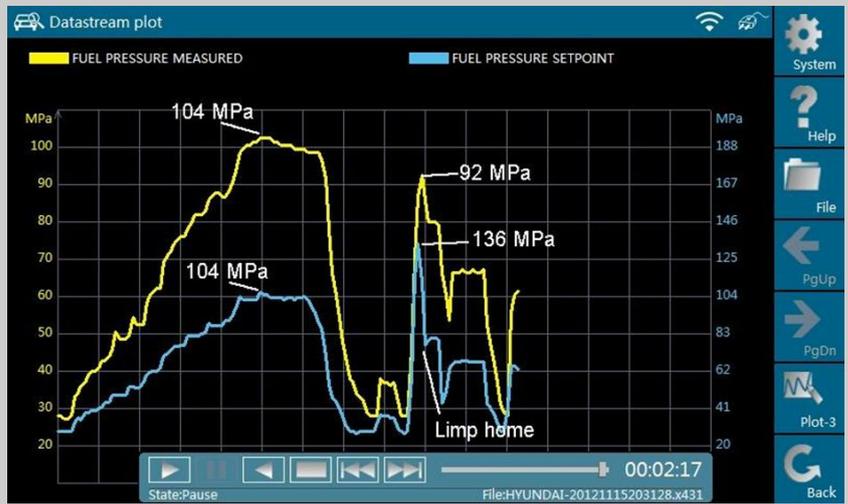
www.aecs.net

The PDV controls the pressure in the rail by opening or closing the rail to the return a certain amount. The opening rate of the PDV valve is a variable electromagnetic force working in against the variable hydraulic Diesel fuel pressure. The ECU will determine the rail pressure set point (desired rail pressure) based on operating conditions.

Both the SCV and PDV will get to work to make the actual rail pressure match the desired rail pressure by changing the current through both those valves, through duty cycle control.

Let's measure!

We used the Launch scan tool's recording function just to see where we had to go. (Picture 1) The actual pressure kept perfectly following the desired pressure



Picture 1 : Launch GDS scan tool recording of the actual rail pressure (yellow trace) vs desired pressure (blue trace). Please note the different MPa scales.

while slowly accelerating to cut off speed and decelerating (first part of the graph).

When full acceleration takes place the desired pressure goes up to 136 MPa but the actual pressure does not rise above 92 MPa when the vehicle falls into limp home, yet the pressure is able to get up higher than 92 MPa.

Why?

Why does the pressure follow fine, while slowly getting up to max and not when getting up to max pressure quickly? Remember there are no hints or tips under the bonnet. At first we suspected the frequency air mass sensor as a quick

snap open of the electronic throttle might have created a sudden air rush. The sudden air rush could have set the requested torque (and desired rail pressure) too high. We have seen a number of similar frequency air mass sensors reporting an air quantity, which was too high. The SCV, pump, and PDV might not have been able to raise the pressure quick enough, causing the fault. Lowering the frequency with the ATS scope signal generator made this engine run beautiful.

A new air mass sensor was ordered but did not fix the problem.....

Scope

This is where the scope is necessary. We recorded with the ATS 5004d 4-channel scope. The channels recorded are: Ch1 Press dump valve, Ch2 Injector, Ch3 Suction control valve, Ch4 Rail Pressure sensor. The PDV (Ch1) and SVC (Ch3) were converted by the scope software into analogue lines. Both were set up so

AIR CONDITIONING ECK 2900

\$11,950 (+gst)

Comes with these options

- A/C DIAGNOSIS MODULE (DIAKIT): integrated, for all types of A/C systems, featuring printout of diagnosis and problem solution.
- HYBRID: hybrid-vehicle service tube flushing function

RECOVERY OIL DISCHARGE VACUUM TRACER OIL REINTEGRATION GAS CHARGING

Product catalogue at www.aecs.net

highprecision RT34A NFO1234VF UPgradable

ATS500XM 2 Ch scope with Sig.gen.

NEW SCOPE !

\$3,840 + gst

[Read More](#)

CAT-401 Transmission Flush

The CAT-401 auto transmission changer can complete the flush and fluid exchange in 20 minutes for transmissions, torque converters & radiators.

\$2,900 + gst

LAUNCH

[Read More](#)

2013 Product catalogue at www.aecs.net

that an increase in the duty cycle should have an increase in pressure as result. We tested that with the ATS 5000 signal generator.

First, we accelerated gently, just like the recording with the scan tool. (picture 2)

Both the SCV and the PDV traces do not move to ridiculous values, meaning that the ECU has the rail pressure under control, i.e. the actual rail pressure follows the desired rail pressure.

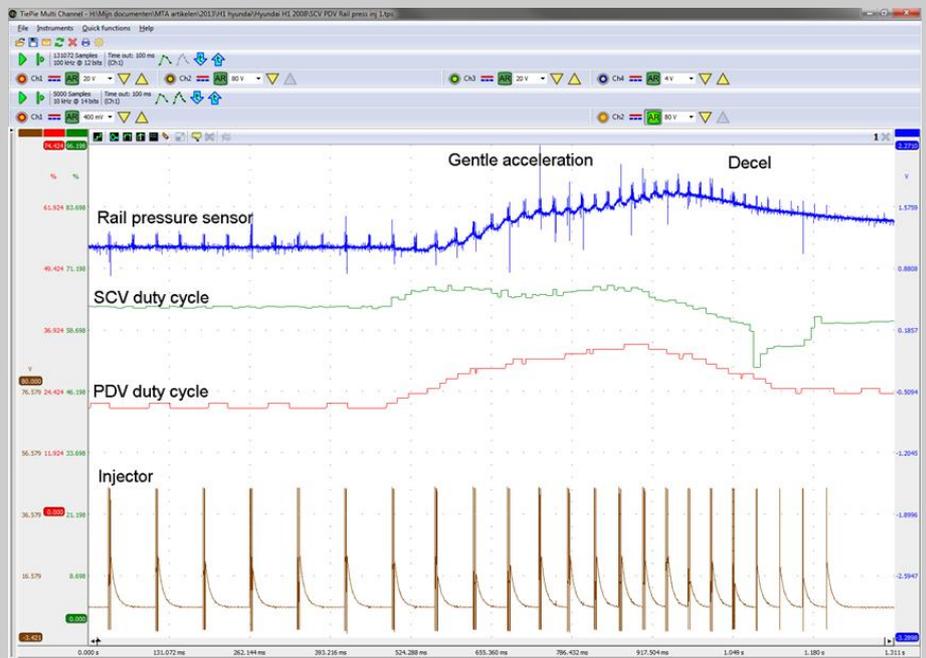
Next, we had to accelerate fully. (picture 3)

The full acceleration recording told us an important story. The pressure does not rise linear, at the indicated area and the pressure seems to suddenly stop rising quickly, yet the only items that are affecting the pressure (pump, SCV and PDV) seem not to be responsible for backing the pressure increase off.

What's faulty?

We could still have four possible faults: SCV, PDV, Pump, Rail pressure sensor. All of these items had been replaced at some stage by someone we were told. Testing was the next step.

With the ATS 5000 scope and signal generator we activated the SCV to fully open and the PDV to fully closed. This should increase the rail pressure dramatically on this running engine. No matter what we did, we could according to the scan tool not get the pressure above 110 MPa at



Picture 2: ATS 4 channel scope recording of rail pressure, SCV, PDV and injector.



Picture 3: ATS recording during full acceleration, when engine falls into limp home.

4500 RPM. The rail pressure should easily go up to double that. We supplied the pump with external Diesel to make sure there were no restrictions in the supply. No difference!

Pressure relief valve

Look again at what is in front of us. Look at the scope recording where the kink is in the pattern. This looks just like the pressure graph of a mechanical Diesel pump increasing rotational speed, when the mechanical pressure relief valve opens to the return.

Next, we suspected the rail pressure sensor. We altered the signal from the rail pressure sensor to a higher value, but still the engine was bogging down with fully activated SCV and PDV valves.

However, this system has no mechanical pressure relief valve! Or has it... The only return to the tank in this system is the PDV discharge line, so if there is a faulty pressure relief valve, it will be this valve, which is leaking.

OBD break out box + Pin ID

\$208 + gst

OBD breakout box and communication pin identifier.

- ▶ Extension lead for scan tool.
- ▶ LED's identify communication protocol.
- ▶ LED window shows supply voltage.
- ▶ Handy torch in Female connector.
- ▶ Easy to diagnose CAN data bus with scope.



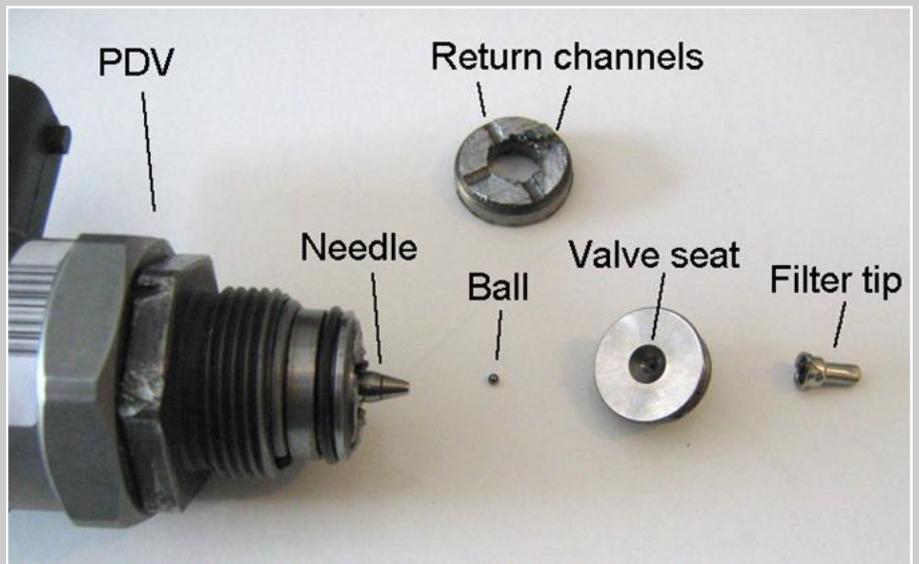
Bingo!

We checked the return line with a clear hose while the valve was fully activated (closed) with the signal generator of the ATS scope. During light acceleration a tiny bit of return flow was visible, but during hard acceleration full flow took place, just as the kink appeared in the graph.

A new rail with PDV was ordered and fitted with perfect results.

The old PDV was taken apart and some dirt was found in the valve.

The ball bearing needs to seal properly when the magnetic field of the solenoid pushes onto the ball. In this case a tiny bit of grit kept the valve open on a small leak, increasing the square surface area of the valve where the hydraulic rail pressure acted upon. An increase in



PDV exploded view.

pressure created a strong enough force to open the ball bearing valve in against the electromagnetic force the solenoid valve needle put on the ball bearing.

Conclusion

This job ended up being very

expensive as a result of the work all workshops involved had done.

There is a lot more detail to this job than you read in this article. We spend 24 hours on this job here at AECS, which puts it right amongst the harder cases we have dealt with. Yet it was so simple in the end, it always is.

Prepare for cases like this with appropriate training, a backup team and real equipment. Make AECS your partner in diagnostics.

Extra filter unit with glass bowl (bowl not visible).

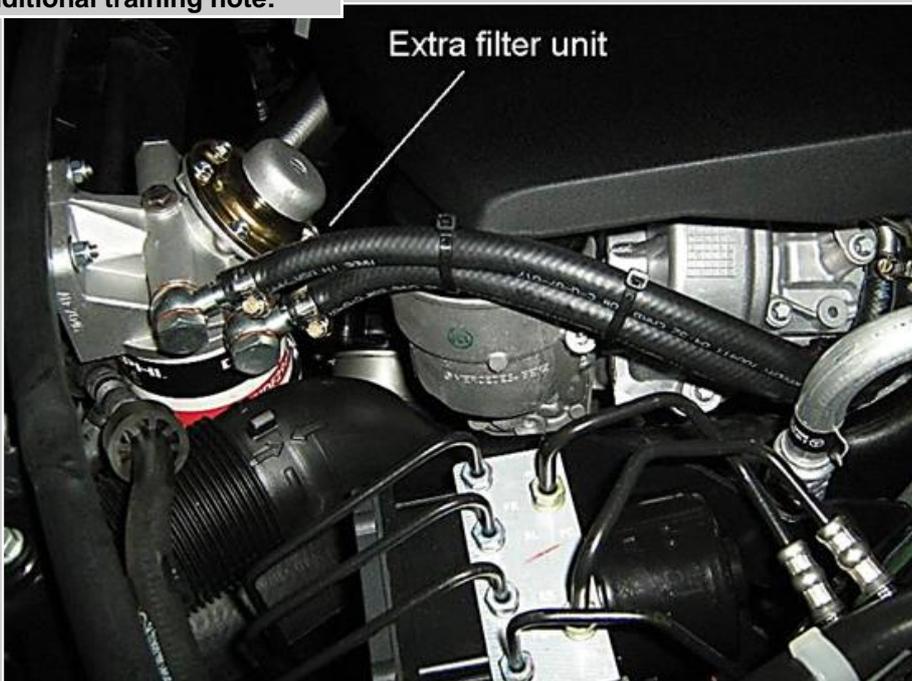
have electric lift pumps in the tank pushing fuel up to the high-pressure pump. The pressure from the lift pump can be more than 5 bars.

Use as hoses to and from the extra filter unit SAE 30R9 not SAE 30R7 as I did.....

Herbert

For **AECS Ltd:**
H.P. Leijen
(trainer/research)
E-Mail: hpleijen@aecs.net

Additional training note:



During our DMS 1-3 common rail Diesel training, we advise to fit to any common rail Diesel vehicle (also brand new ones) an extra filter unit with water separation bowl. If water enters the fuel system, the pump, valves, and injectors need to be replaced. The genuine filters used on many modern vehicles are not having enough water separation area, plus the water sensor with

electrodes protruding into the filter react often too late. It is incredibly expensive to replace the damaged items. It will always end up in a battle with your customer, as water damage to these components is not covered by any warranty and fuel companies do not like to admit that the water came from their fuel station (prove it...).

Many common rail Diesel vehicles

2013

AECS

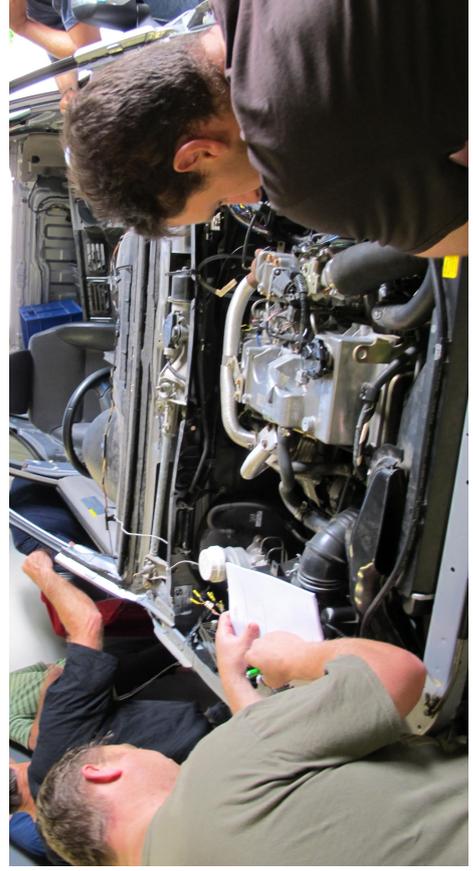
Training Calendar

	Sundays
	Public/school Holidays
	YES Association
	PRIVATE Training

Please note: All effort has been made to ensure the training & course dates are correct, however please contact us first before publishing information from this calendar.

March	April	May	June	July	August
1 YES!	1 Easter Monday	1	1	1	1 Auckland EMS1-4
2	2	2	2	2	2 Auckland EMS1-4
3	3	3	3 Queens birthday	3	3
4	4	4	4	4	4
5	5	5	5	5	5
6	6	6	6	6	6 Whangarei SCAN1
7	7	7 ChCh SCAN1	7	7	7 Whangarei SCAN1
8	8	8 ChCh SCAN1	8	8	8 Auckland EMS1-3
9	9	9 ChCh AED	9	9	9 Auckland EMS1-3
10	10	10 ChCh AED	10	10	10
11	11 Taranaki Anniversary	11	11	11	11
12	12 Private Training	12	12	12	12
13	13	13 ChCh EMS 1-1	13	13	13
14	14	14 ChCh EMS 1-1	14	14	14
15	15	15 ChCh ATS 1-1	15	15	15
16	16	16 ChCh ATS 1-1	16	16	16
17	17	17	17	17	17
18	18 Wellington SCAN1	18	18	18	18
19	19 Wellington SCAN1	19	19	19	19
20	20	20 Private Training	20	20	20
21	21	21	21	21	21
22	22	22	22	22	22
23	23	23	23	23	23
24	24	24	24	24	24
25	25 Anzac day	25	25	25	25
26	26	26	26	26	26 YES!
27	27	27	27	27	27 YES!
28	28	28	28	28	28 YES!
29	29	29	29	29	29 YES!
30	30	30	30	30	30 YES!
31	31	31	31	31	31

For more information on the Training Key and course descriptors see www.aecs.net



Pre- ENROL

AECS have been training automotive diagnostic technicians for 13 Years

Name:

Business name:

Phone Number:.....

Address:

Email:

Preferred training:..... Preferred Location:.....

For enquiries or to register for this seminar contact

Ph: 06 874 9077, Fax: 06 874 9078 or E-mail: christine@aecs.net