1382 VACUUM BRAKING REPORT

DESIGN, INSTALLATION and INITIAL TEST RESULTS

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Issue B dated 18th August 2025

This report will be updated as installation progresses.

A final report at issue 1.0 or above will be issued when 1382 is Fit To Run (FTR)

Summary of installation status:

Duplex vacuum gauge connections now corrected.

Filter/Sniffer unit check valve is now removed.

Repeat brake test confirms 1382 vacuum brakes now work correctly.

Repeat test with Stove coach proves 1382 vacuum can stop train.

Task 11 to be completed before proceeding to FTR checks.

Tasks 12 and 14 are future upgrades.

The vacuum system is NOT FTR with passengers at the date of this report.

1382 vacuum installation.

For clarity:

- *This is a vacuum installation so maximum air pressures involved are mostly <30psi.*
- *The exhauster exhaust manifold and oil feed pipes may see slightly higher pressures.*
- *Oil feed pipe uses hydraulic pipe with professionally fitted and crimped banjos.*
- *Rigid pipe fittings(elbows, bends, unions etc) are rated 150psi or above, galvanised for rust protection.*
- *Pipe lengths are pre threaded to requirements.*

Design:

1382 vacuum braking installation is based on and uses first generation DMU design equipments (see appendix C). DMU vacuum installations have a high vacuum train pipe (28" Hg) with reservoir cylinder and a brake release vacuum pipe at 21" Hg. The initial installation for 1382 will not include the reservoir – all this means is taking brakes off will take a little longer.

Repurposed DMU equipments used are:

- Clayton-Dewandre Rega 242-1 exhauster
- Westinghouse automatic feed valve set to maintain 21"Hg vacuum in the train pipe
- Gresham & Craven 1.1/2" drivers brake valve
- Westinghouse filter, sniffer valve and check valve which is not required has been removed
- Duplex vacuum gauge uncalibrated
- Westinghouse isolating valve – not initially installed

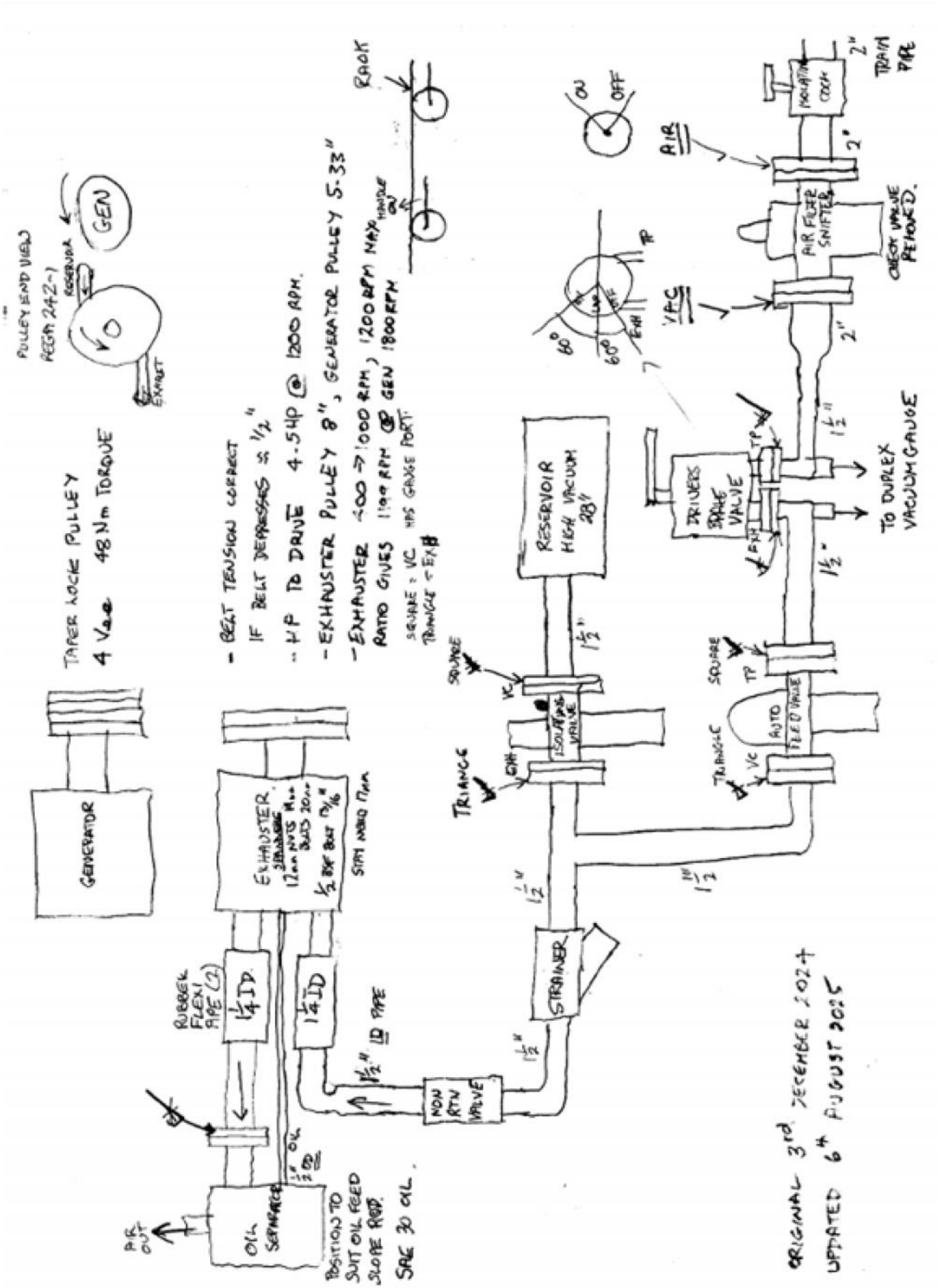
New equipments used are:

- check valve – stainless steel 304
- strainer – stainless steel 304
- pipe fittings – galanised or stainless steel 304
- taper lock and bush type 2517, ½" BSW grub scew torqued to 48Nm. Use of keyway not required.
- SMB1410 vee belts

Parts identification

1382 VACUUM INSTALLATION DESIGN DIAGRAM

(adapted from 1st generation DMU vacuum installation – see Appendix C)



Installation work steps:

1) Clean 1382 generator shaft stub, smooth any blemishes, remove all paint and grease/oil deposits using methalated spirits. Install taper lock and bush onto generator shaft – torque to 48Nm as per manufacturers instructions. Taper lock and bush SPB140 x 4, material GHISA EN-GJL-200.
Source:
- Bolton engineering.

Taper lock installed
Exhauster mounted in place
For operation two SMB1410 vee drive belts are used

2) Fabricate and assemble REGA 242-1 exhauster mounting bracket and install in 1382.
Angle iron mild steel 60 x 60 x6mm. Thickness is the same as the original DMU mounting.
Source:
- Angle iron supplied by local engineering firm.
- 12mm bolts/nuts/washers/spring washers high tensile steel 8.8. Various as required.

3) install REGA 242-1 exhauster to mounting bracket using original castle bolts and new split pins.
Source:
- exhauster is reused standard equipment from DMU.
- Mounting bar, bolts etc refurbished originals. Manifolds were removed and vanes inspected. All in good non rusty condition and plenty of oil present. No slack observed on drive shaft or bearings. Manifolds gaskets replaced with new paper gaskets. 2 new port pipe adaptors machined (7/8" BSP thread).

Exhauster installed on mounting bracket – oil feed pipe shown in place

4) install oil separator. New flexible oil feed pipe fitted to feed exhauster.
Source:
- oil separator is reused standard equipment from DMU.
- Flexible oil feed pipe manufactured by Hams, Market Harborough using high pressure rated fittings and pipe.

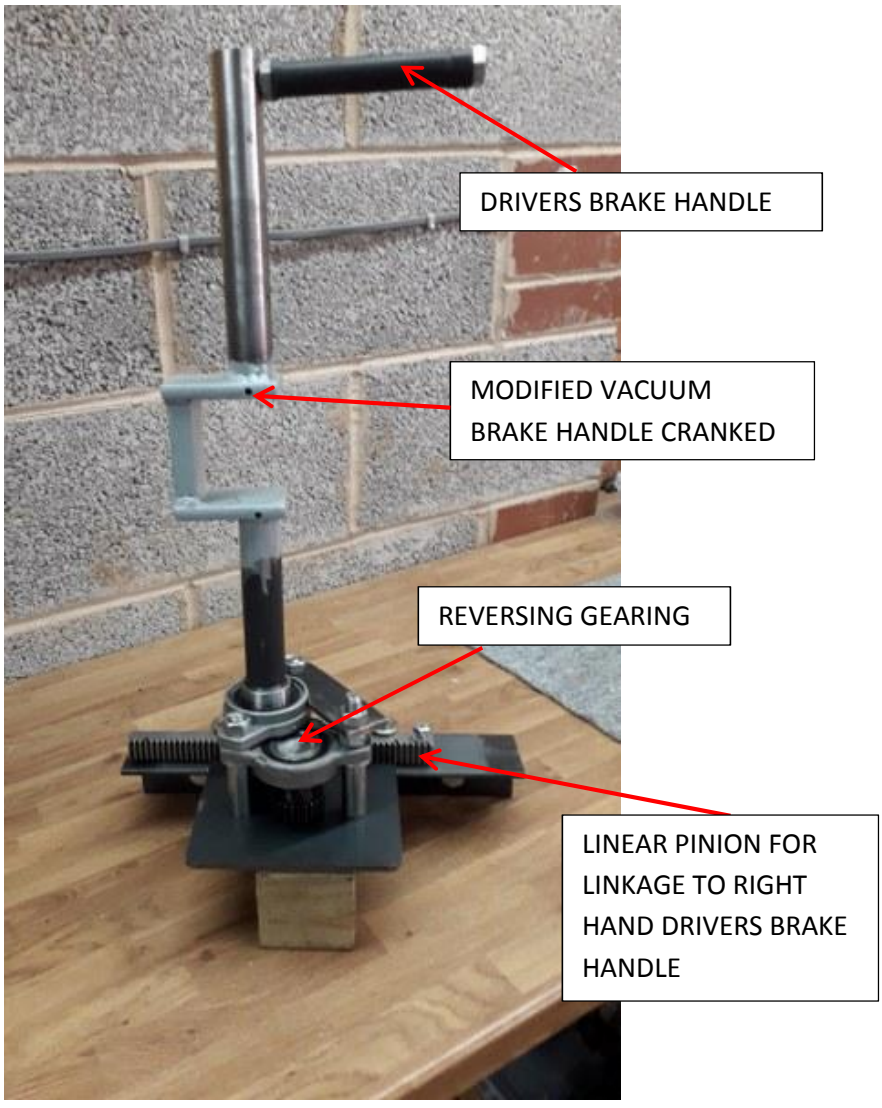
5) manufacture exhauster adaptor fittings and fit flexible pipe for vacuum and exhaust ports. T bolt stainless hose clip clamps used for securing flexible pipe to hosetails.
Source:
- Adaptors manufactured by JMEngineering using EN1B hex steel bar.
- flexible pipe is Flexible EDPM wire reinforced rubber suitable for water and air. Working pressure 20 Bar (290psi) supplied by Ultimate Car Parts.
- T bolt hose clips supplied by jml-henderson.

6) fabricate vacuum pipe and equipments to fit into disused battery area to the left side of 1382, into the cupboard under the cab console right hand side and through engine bay to existing vacuum through pipe connection (previously installed by Briddons). See pictures for detail.
Pipe runs are 1.1/2” feeding into a 2” train pipe. An exception is the exhauster flexible pipes which are 1.1/4” fed from 7/8” ports (this is as the exhauster was designed).
Pipe runs are prefabricated in maneagable runs with unions for ease of installation and maintenance.
All screwed pipe fittings to be sealed with PTFE tape as appropriate.
Ensure all flexible pipes are protected from chaffing.
Ensure all rigid pipe clamps include neoprene vibration damper.
Source:
- check valve, stainless steel, any position mount, supplied by Flowtech (Compressor & Vehicle Lifting)
- strainer, stainless steel 304, for water/oil/gas, suppied by Ebay-pajiua2 Sheffield
- galvanised malleable iron fittings (elbows,bends,adaptors, unions etc) cast iron to EN1562, banded with reinforcement, supplied by Pipedream
- drivers brake valve unions are stainless steel 316
- stainless steel hose tails, max. rated working pressure 300psi, supplied by air system controls.
- pipework supports are 10mm or 12mm threaded rod, off the shelf items
- special flanges supplied via JMEngineering
- flange gaskets made using 2mm neoprene rubber gasket sheet 70deg shore A hardness suitable for marine gasket making, supplied by Camthorne Industrial Supplies.

Pipework and fittings dry run assembly

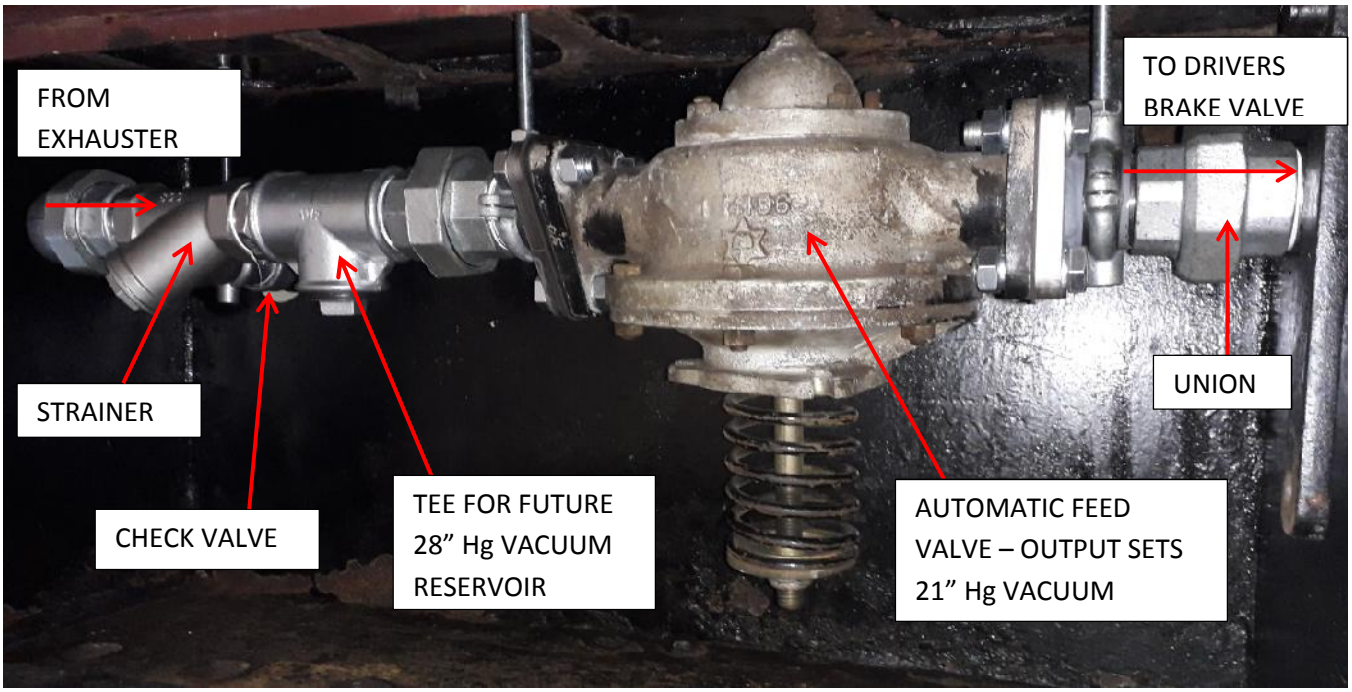
7) Fabricate drivers brake valve reversing assembly.
The vacuum drivers brake valve and the existing air drivers brake valve operate in opposite directions. Operationally this is not convenient and could be confusing so the vacuum brake handle requires a reversing mechanism. Due to the limited space available a spur gear assembly is used. This conveniently allows a linear gear rack to be included to connect with the right hand vacuum drivers brake handle. The linear motion minimises the clearances needed for the brake handle linkage when passing through the centre of the console.
Spur gears and linear rack are Mod1.5 size. The mechanism uses KF006 self aligning bearings to provide smooth brake handle operation. The spur gear ratio is arranged so the vacuum and air brake handles operate over approximately the same angle range. Spur gear shaft hole is increased to suit 30mm shaft.
Spur gear hex grub screws (2 per gear) are secured with blue thread locker and additionally seated in indents in their shafts to prevent slippage.
Source:
- KFL006 30mm zinc alloy pillar block bearing secured with 12mm bolts, supplied by Ebay – kerrken-49
- Mod1.5 17x17mm steel tooth rack, supplied by CNC Planet
- Mod1.5 Spur gear C45 hardened steel 32 teeth, supplied by Ebay – 002-supermong
- Mod1.5 Spur gear C45 hardened steel 25 teeth, supplied by Ebay – 002-supermong
- 30mm o/d black mild steel rod, supplied by Ebay – steelworkx
- 12mm bolts/nuts/washers/spring washers high tensile steel 8.8. Various as required.

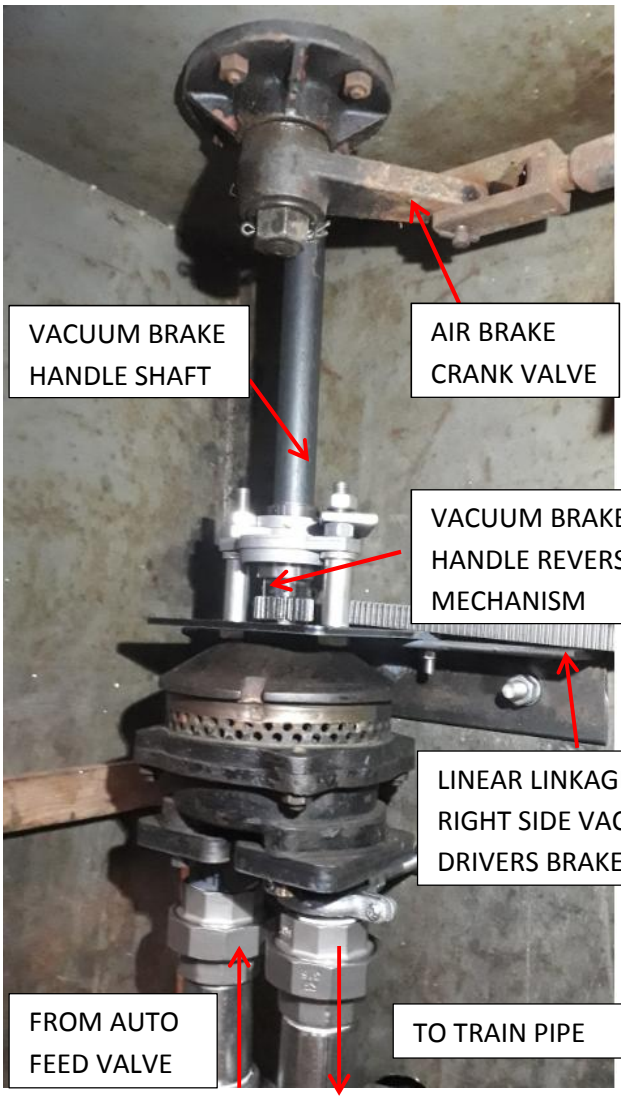
Vacuum drivers brake valve reversing assembly dry run assembly
(see also para's 9 and 11 for the brake handle shaft modification)



8) install vacuum pipe and equipments into disused battery area and underside of cab console left side cupboard. Position, mark and drill holes for pipework from engine bay through to cab under console – 4 x 70mm holes. Position, mark and drill mounting holes for pipework hangers and drill/12mm tap pipework supports.

Exhauster to automatic feed valve installed





Automatic feed valve to drivers brake valve installed
The brake valve handle reversing mechanism is also shown installed for fit checking. The crank at the top of the picture is for the air brake handle and the fit check identified a foul between the vacuum brake handle shaft and the air brake linkage.

Foul to be mitigated by fabricating a cranked shaft.
See work task 11.

9) install vacuum pipe and filter/sniffer valve to train pipe connection in engine bay.
Note: The filter/sniffer valve also contains a check valve. This is not required for 1382 vacuum installation since the filter/sniffer is after the drivers brake valve and must allow air flow both ways. The check valve has been removed.

Filter/sniffer valve andconnection to train pipe

10) install duplex vacuum gauge on cab console using 8mm copper pipe and appropriate adaptors. Gauge pipe feeds are taken from the bottom of the drivers brake valve pipes.

Duplex vacuum gauge installed in cab console

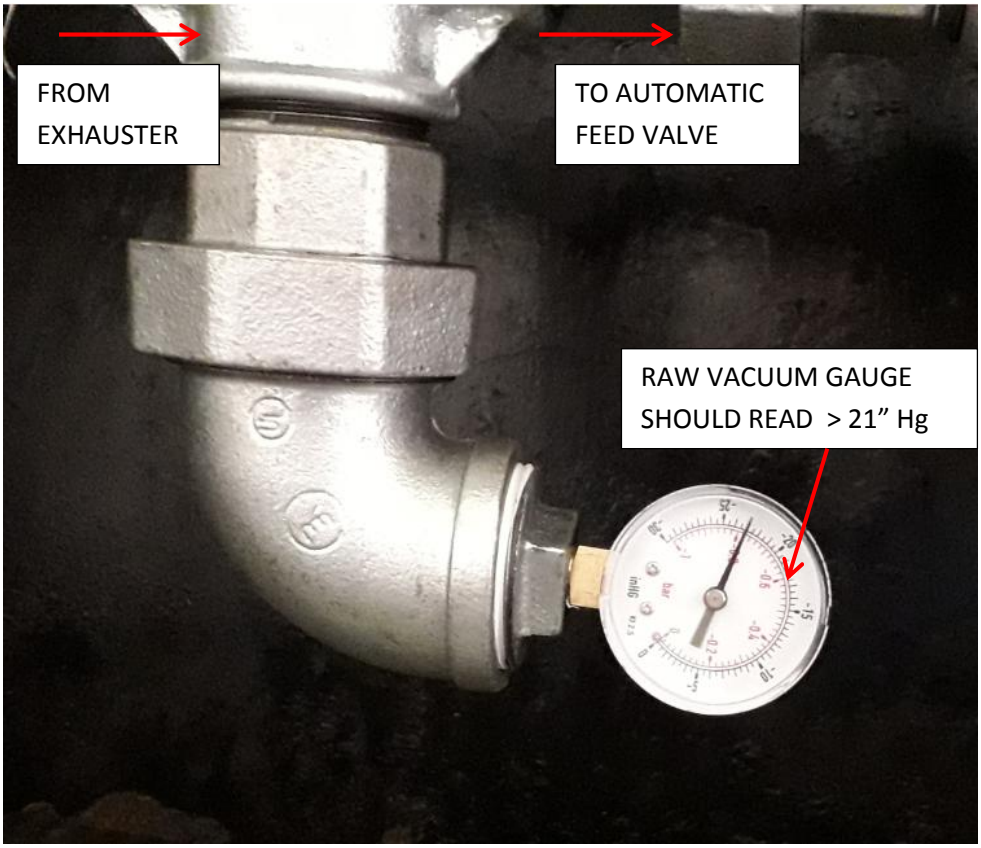
11) The vacuum drivers brake handle reversing assembly fit check revealed a foul with the existing air brake handle linkage. A wooden pattern was made to check clearances from which a metal cranked vacuum drivers brake handle shaft will be fabricated. See appendix A for detail.

Cranked shaft pattern test fit

12) Fabricate right hand drivers brake handle and linear linkage. This is a simple single gear mechanism driving the linear tooth rack to connect to the left hand vacuum drivers brake handle and brake valve assembly.

13) Fit raw vacuum gauge to reservoir cylinder tee off point using a 90deg union.
This location corresponds to the exhauster pipe in a DMU installation and maintains a high vacuum of 20” Hg from all exhausters. 1382 only has one exhauster.
This tee will eventually connect to the vacuum reservoir cylinder (task 14).

Raw vacuum gauge



14) Fit high vacuum reservoir cylinder – future upgrade to speed up brake release. TBD.

The vacuum reservoir cylinder and mounting kit has been donated by Northampton Ironstone Railway Trust (NIRT). The cylinder is from an old coach and is being inspected and modified for 1-1/2” pipe connection.

Initial testing – no wagons/coaches attached:

Test date 3rd August 2025

T1) Preparation:

- Check all unions and bolts are tight and split pins are correctly fitted in exhauster tension adjusting bar.
- Fit 1 vee belt to the exhauster and secure in place by tightening the tension adjusting bar nuts.
- Tighten the exhauster mounting castle nut but do not fit split pins at this time.
- Fill oil separator with 15/40 engine oil
- Train pipe isolating cock to open (through).
- Temporarily remove vacuum drivers brake valve reversing assembly and fit original brake handle

- Set to brake on position (ie train pipe at atmospheric pressure – picture shows lap position)

T2) Start 1382 using the normal procedure. Be prepared to stop promptly if problems occur.
Manual brake should be on for all testing.

T3) Check duplex gauge to confirm vacuum is being created. Once stabilised record readings.

20” Hg on train pipe gauge. 0” Hg on vac. chamber gauge.

Gauge is plumbed in back to front – to be corrected – minor issue so proceeded with next test.

T4) Record raw vacuum gauge reading.

22-23” Hg on raw vacuum gauge.

Acceptable at this stage as indicates automatic feed valve is regulating the vacuum to 21”Hg for train pipe.

T5) Operate the vacuum drivers to brakes off position.

20” Hg on train pipe gauge. 20” Hg on vac. chamber gauge.

Confirms drivers brake valve is functioning correctly and reconfirms duplex vacuum gauge is plumbed the wrong way round.

T6) Operate the vacuum drivers brake valve to confirm lap works and that any vacuum level can be set and held.
This was confirmed by setting a train pipe vacuum level to 15” Hg and held steady.

T7) Operate the vacuum drivers to brakes on position.
This was confirmed by the train pipe vacuum level reducing to 0”Hg almost instantly. A short air burst was heard from the drivers brake valve exhaust port confirming air being inlet to the train pipe.

T8) Stop 1382 engine in accordance with normal procedure.

T9) Remove exhauster vee belt.

CONCLUSION FOR INITIAL TEST

1382 initial test indicates the vacuum brake installation is functioning as expected.
Further work tasks are required:

a) duplex vacuum gauge plumbing is crossed over – to be corrected.

b) complete work tasks 11 and 12.

c) repeat test using a wagon or coach once item a) is corrected.

Repeat test after removal of check valve in filter/sniffer and correcting duplex vacuum gauge feeds:
Test date 6th August 2025
Vacuum gauge connections are corrected. Filter/sniffer unit check valve has been removed – not required.

T1) Preparation:
- Confirm filter/sniffer unit is refitted and unions are tightened.
- Fit 1 vee belt to the exhauster and secure in place by tightening the tension adjusting bar nuts.
- Check oil separator is topped up with 15/40 engine oil
- Train pipe isolating cock to open (through).
- Temporarily remove vacuum drivers brake valve reversing assembly and fit original brake handle.
- Set drivers brake valve to brake on position.

T2) Start 1382 using the normal procedure. 1382 hand brake must be on for steps T3 to T6.

T3) Check duplex gauge to confirm vacuum is being created. Once stabilised record vacuum readings.

vac. chamber: ____20+___"Hg train pipe: ____0_____ "Hg

T4) Record raw vacuum gauge reading.

___22-23_____" Hg

T6) Couple up to stove for brake test. Once coupled set stove hand brake to off.

T5) Set 1382 vacuum brake valve to brakes off position.
Once stabilised record vacuum readings and confirm stove brake shoes are off. Confirmed

vac. chamber: ____20+___ "Hg train pipe: ____20+___"Hg stove gauge: ___21_____ "Hg

T6) Set 1382 vacuum brake valve to brakes on position.
Once stabilised record vacuum readings and confirm stove brake shoes are on. Confirmed

vac. chamber: ____20+___ "Hg train pipe: ____0____ "Hg stove gauge: _____0____ "Hg

T7) Perform a running test with stove and confirm 1382 can stop using vacuum braking. Confirmed

T8) Return to up yard and apply stove hand brake.

T9) Apply 1382 air brakes and stop 1382 engine in accordance with normal procedure.

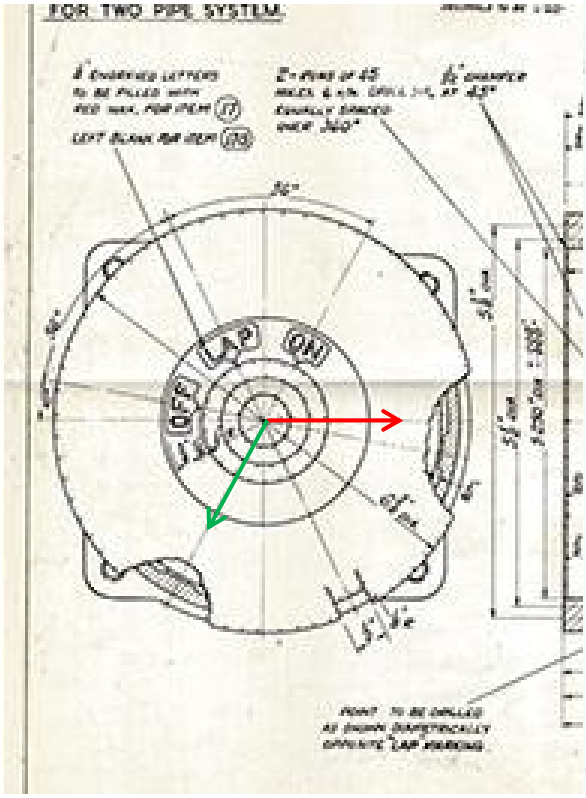
T10) Apply 1382 hand brake then uncouple stove.

CONCLUSION FOR REPEAT TEST

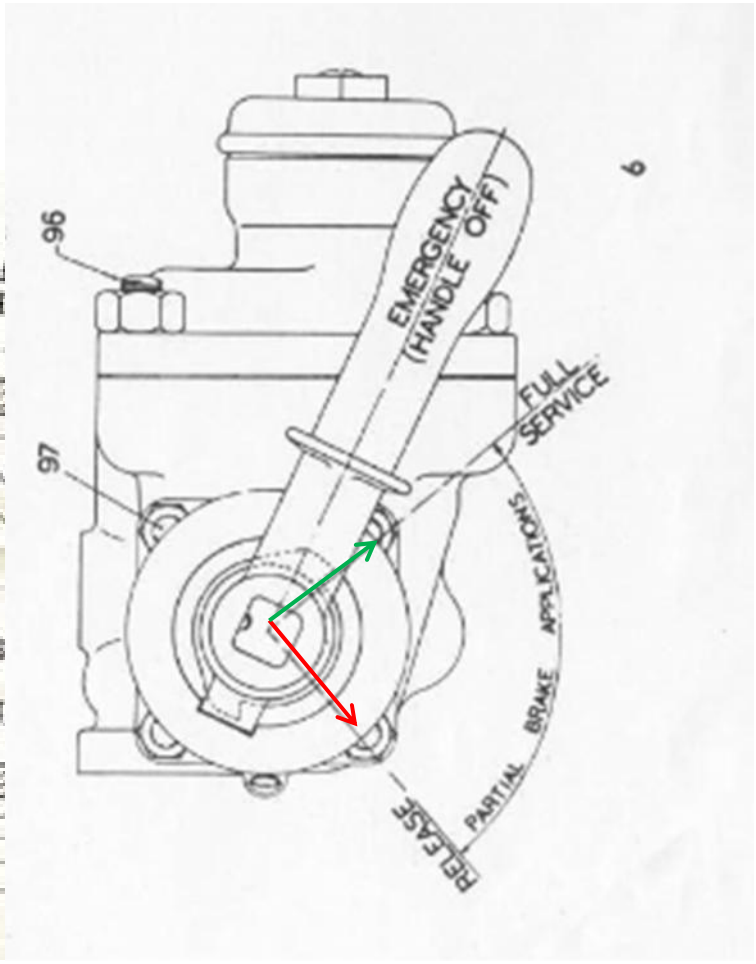
1382 repeat test confirmed the 1382 vauum brake installation is functioning correctly.
After several runs in the up yard, no anomalies were observed with vacuum braking.
The drivers brake valve LAP function was also checked and performed correctly.
Typical time to evacuate Stove and 1382 vacuum pipes is 30-50 seconds at engine idle speed.

a) Work task 11 to be completed before FTR exam.

Appendix A: Brake valve operating directions



vacuum brake valve



air brake valve as fitted to 1382

OFF = BRAKE OFF = RELEASE = RED
ON = BRAKE ON = FULL SERVICE = GREEN

The brake valves operate in opposite directions.
A reversing gear needed on vacuum drivers brake handle to be consistent with existing air brake handle.
The reversing gear also reduces the vacuum handle angular movement to match the air brake handle.

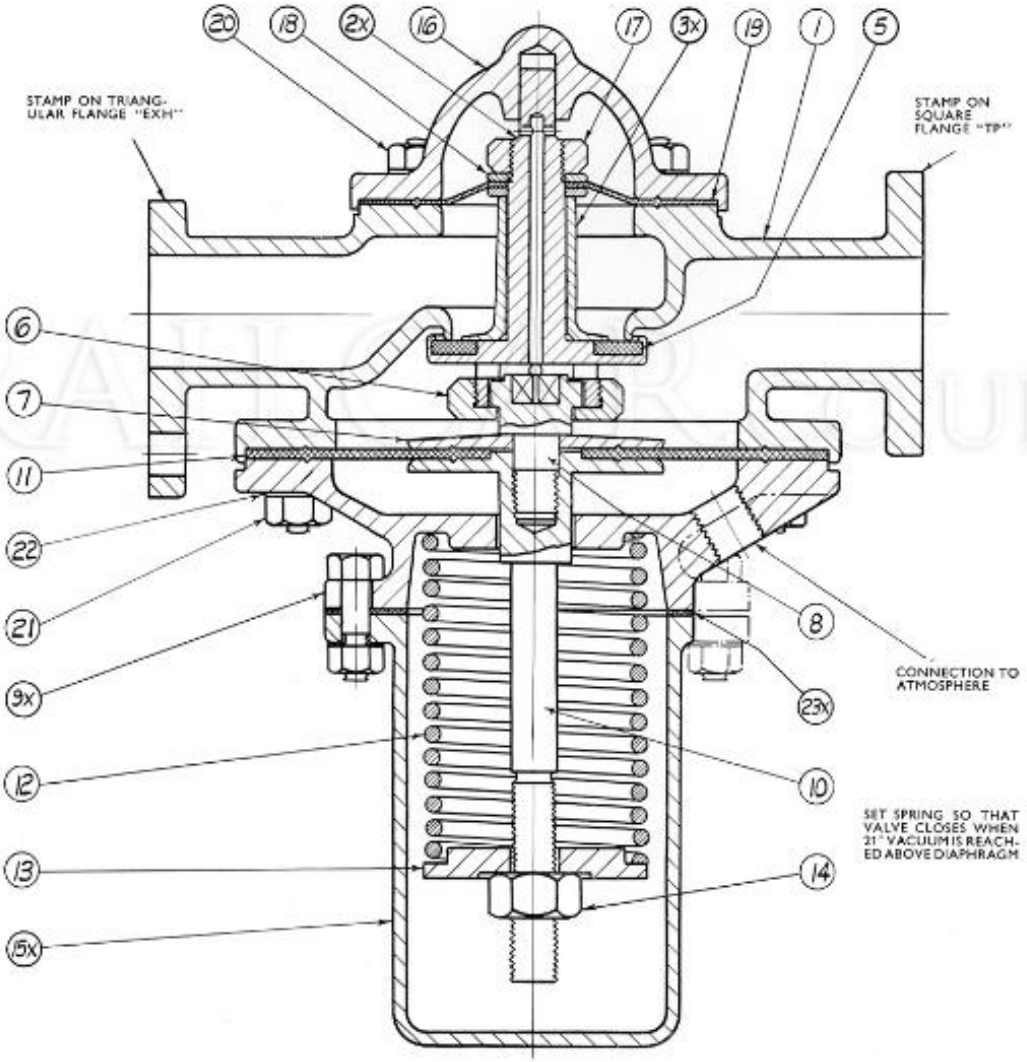
Appendix B: Automatic feed valve drawing

Pt. No.		Description.
1		Top Body
2, 2X		Valve (See Notes)
3		Sleeve for Valve (Screwed Casing Type)
3X		Sleeve for Valve (Flanged Casing Type)
4		Washer (Screwed Casing Type)
5	*	Valve Seating
6		Adaptor Nut
7		Diaphragm Plate
8		Adaptor
9		Bottom Body (Screwed Type)
9X		Bottom Body (Flanged Type)
10		Spindle
11	*	Diaphragm
12	*	Spring
13		Adjusting Plate
14		Adjusting Nut
15		Bottom Cap (Screwed Type)
15X		Bottom Cap (Flanged Type)

Pt. No.		Description
16		Cover
17		Lock Nut
18		Washer
19	*	Diaphragm
20		Studs and Nuts, 3/8" B.S.W.
21		Bolts and Nuts, 3/8" B.S.W.
22	*	Shakeproof Locking Washers, 3/8" i/d
23	*	Joint (Screwed Casing Type)
23X	*	Joint (Flanged Casing Type)

* Recommended Spares

Notes : Both types of valve are interchangeable as complete units. When ordering replacement valves, Part No. 2, for the screwed type valve, a new sleeve, Part No. 3X must also be ordered, as the new type valve will not fit the old type sleeve, Part No. 3, the old type of valve not now being manufactured.



Later Flanged Casing Type

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Appendix C: Origin of design for 1382 vacuum brake system

1382 vacuum braking system is an adaption of first generation DMU system shown below.
The same major DMU components are used ie exhauster, automatic feed valve, drivers brake valve and isolating valve. Note 1382 will use only one exhauster.

Sections highlighted in red are implimented for 1382.

A filter/sniffer unit and train pipe isolating cock is added between the brake valve and train pipe (ZZ).
The duplex vacuum gauge currently directly displays vacuum for each drivers brake valve port. Future modification will be to connect one side directly to the train pipe rather than before the filter/sniffer unit and isolating cock.
For initial testing an additional vacuum gauge is fitted at the reservoir tee point.

Sections highlighted in green will be implimented at a later date.
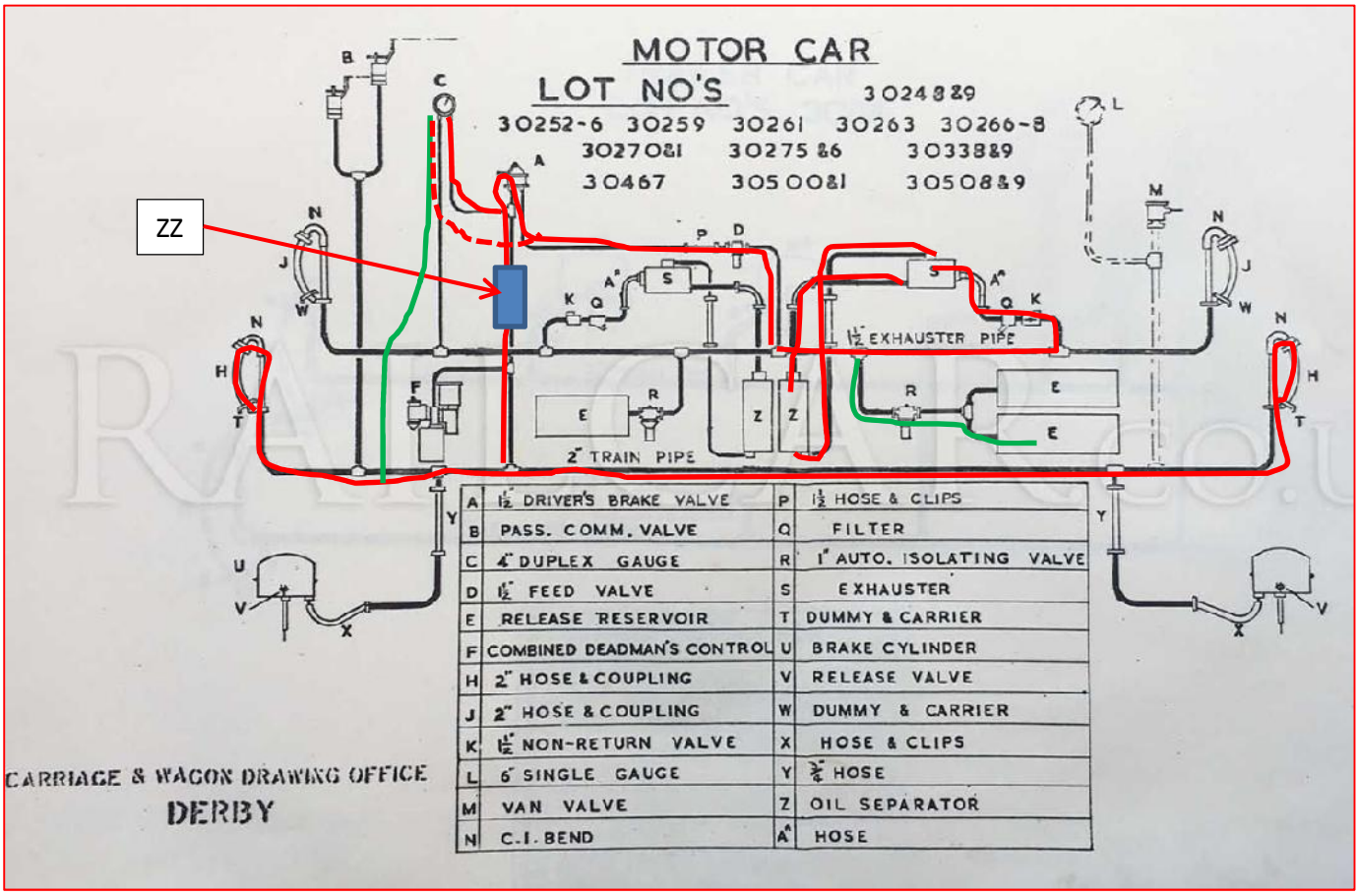
Diagram scan from Railcar website.