Train
Description and Operation

Alstom Transport Ltd. has designed the DMU (Diesel-Multiple Unit) series of which the Class 180 is First Group Leasing Company's version for use by First Great Western Train Operating Company. The Class 180 units are designed to operate as a five car unit over the Great Western and South Wales routes. The First Great Western Train fleet comprises 14 five car units. The five car units are made up of a DMDS (Driving cab, Motor, Disabled, Standard) car, a MF (Motor First) car, a MS (Motor Standard) car, a MKS (Motor Kitchen Standard) and a DMS (Driving cab, Motor Standard) car.

The Class 180 train has a maximum speed of 200 km/h (125mph) and seats 206 passengers (or 204 passengers and two wheelchair passengers). A single DMDS car or a DMS car is 23.71 metres long and weighs 53.00 tonnes, the MF, MS and MKS cars are 23.03 metres long and weighs 51.5 tonnes. All weights given are tare.

The front ends of the train are fitted with Scharfenberg auto-couplers that provide automatic coupling/uncoupling to other First Group First Great Western Trains Class 180 DMUs. In an emergency, it is possible to couple mechanically to other locomotives using an adapter coupler.

Inter-vehicle connection is by means of flexible gangways and semi-permanent couplers. The couplers provide mechanical coupling and incorporate hydro-pneumatic draw gear to accommodate buff and draw. Inter-vehicle electrical and pneumatic connections are by electrical jumper cables and pneumatic hoses. Energy absorbing anti-climbers are mounted on the underframe ends through sacrificial energy-absorbing struts.

The DMDS and DMS cabs are segregated from the saloon by a single-leaf train crew door with emergency burst-through feature. There is no segregation between the driver and the non-driver. Lockable doors prevent passengers from entering the driving compartment of the non-active cab.

Each unit is aerodynamically designed to reduce drag and each has a skirted underside to reduce interior noise.

DMDS CAR

The DMDS (Driving Motor Disabled Standard) driving saloon comprises a Drivers Cab at No. 1 end, one seated area with a vestibule and luggage compartment at No. 1 end and a disabled toilet at No. 2 end. There are 54 standard class seats, two tip up seats and two spaces available for wheelchair passengers. A luggage rack and bicycle stowage is provided at No. 1 end. The vehicle can accommodate a maximum of 56 seated persons all with access to at-seat audio.

A pneumatic powered sliding glazed door at each end of the car separates the seating area from the vestibule and toilet area. Two luggage racks 730 mm wide are provided at the forward end of the car between the back of the front row of seats and the fire barrier partition between saloon and vestibule.

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MF CAR

The MF (Motor First) comprises one seated area with vestibules at both ends of the vehicle and a standard toilet and luggage rack at No. 2 end. There are 42 First Class seats, four tip up seats and space for one wheelchair position at No. 1 end.

The vehicle can accommodate a maximum of 46 seated persons.

MS CAR

The MS (Motor Standard) comprises one seated area with vestibules at both ends of the vehicle and a standard toilet and luggage rack at No. 2 end.

There are 68 standard class seats and four tip up seats.

The vehicle can accommodate a maximum of 72 seated persons.

MKS CAR

The MKS (Motor Kitchen Standard) comprises of one seated area with a vestibule at No. 2 end and a catering/serving area at No. 2 end.

There are 56 standard class seats and four tip up seats.

The vehicle can accommodate a maximum of 60 seated persons.

DMS CAR

The DMS (Driving Motor Standard) comprises a Drivers Cab at No. 1 end, one seated area with a vestibule at No. 1 end and a disabled toilet at No. 2 end.

There are 56 standard class seats and two tip up seats. A luggage rack and bicycle stowage is provided at No. 1 end.

The vehicle can accommodate a maximum of 58 seated persons.

The following pages illustrate the vehicle layouts accompanied by a numerical and descriptive legend.

Two power operated single-leaf sliding-plug doors in each vehicle bodyside provide access to the vestibule and thus the saloon. Saloon doors are enabled by the driver and controlled by passenger-operated pushbuttons both inside and outside the vehicle. A door open or close command can be generated by the crew from the cab or by a passenger using an inside

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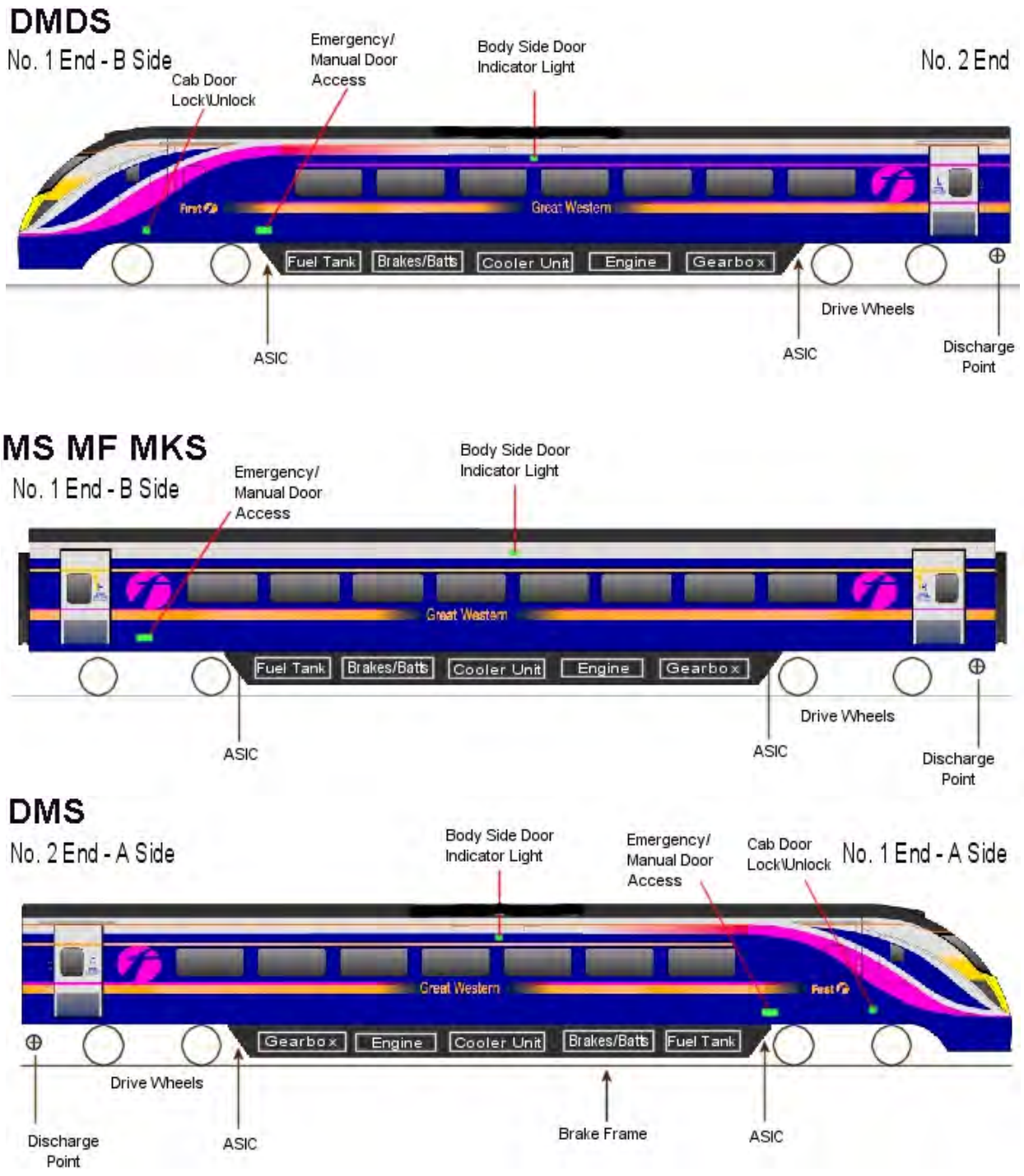
Train Data

Number of Units:	14 x 5 cars		
Unit Numbers:	180101 - 180114		
Coach Numbers:	DMDS Cars are numbered: 50901 - 50914 MF Cars are numbered: 54901 – 54914 MS Cars are numbered: 55901 – 55914 MKS Cars are numbered: 56901 – 56914 DMS Cars are numbered: 59901 – 59914		
Dimensions	Car	Length (m)	Weight (t)
	DMDS	23.71	53.00
	MF	23.03	51.50
	MS	23.03	51.50
	MKS	23.03	51.50
	DMS	23.71	53.00
	Totals	116.51	260.50
Seating	DMDS	54 Standard seats, 2 tip up seats and 2 wheelchairs spaces	
	MF	42 First Class seats, 4 tip up seats and 1 wheelchair space	
	MS	68 Standard seats, 4 tip up seats	
	MKS	56 Standard seats, 4 tip up seats	
	DMS	56 Standard seats, 2 tip up seats	

Train
Description and Operation

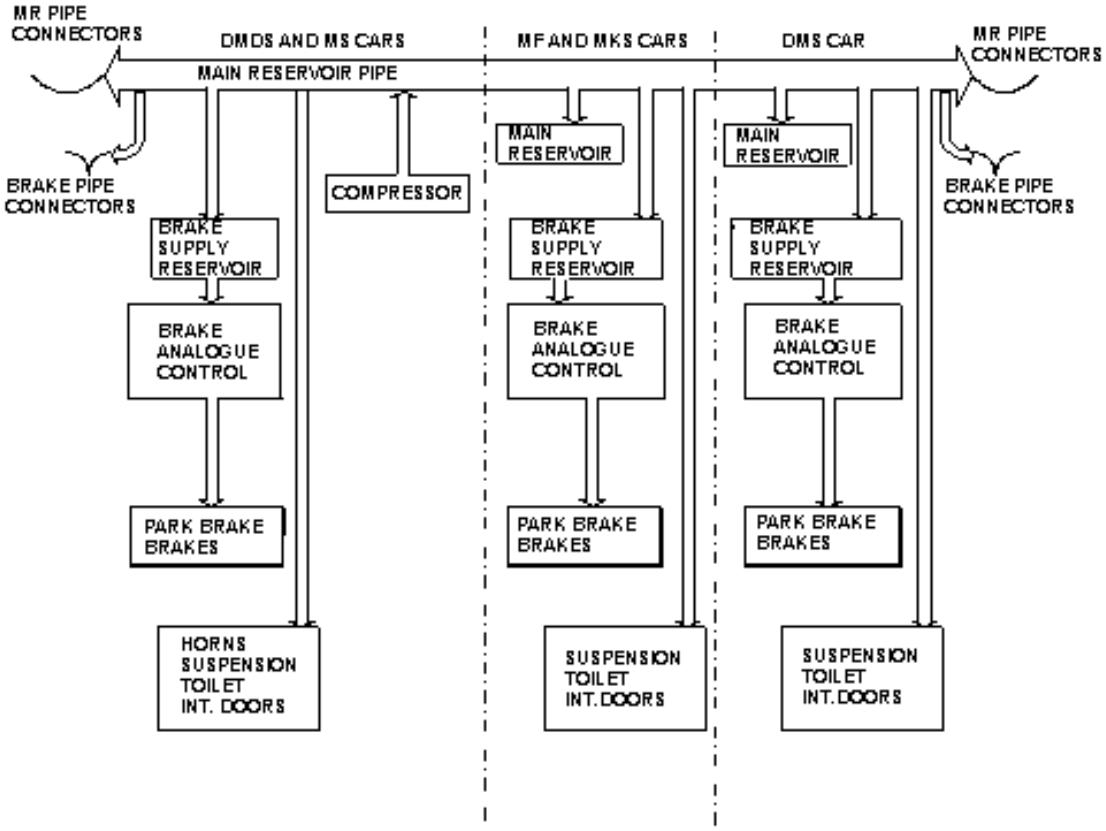
Driving Motor Vehicle End View (Fig.1)

Train
Description and Operation



Class 180 Vehicle Descriptions (Fig.2)

Train
Description and Operation

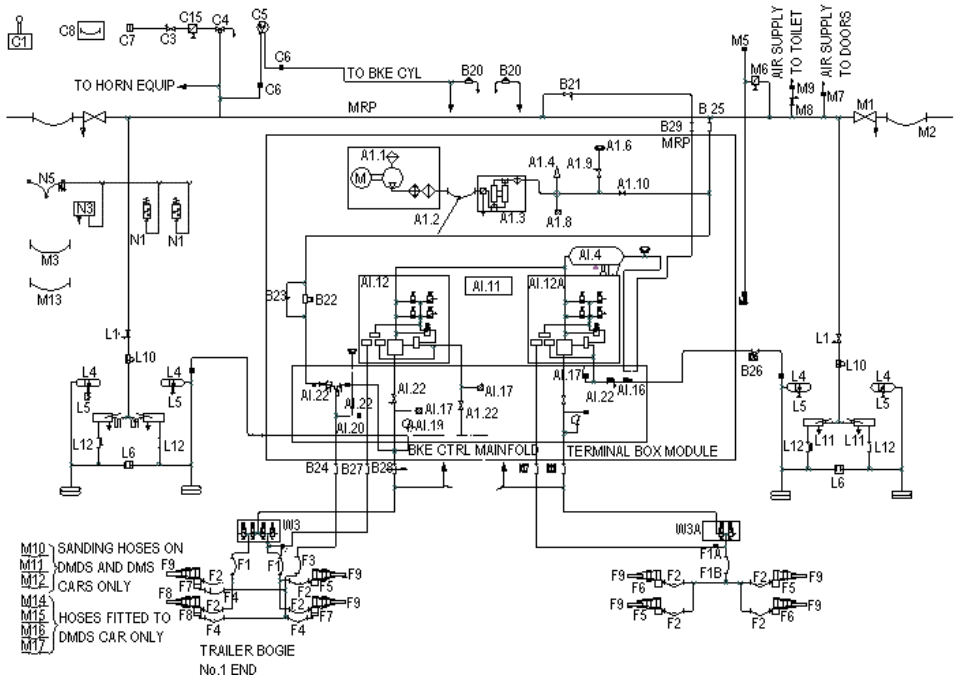


Air Supply System (Fig.5)

The train has a conventional air supply system, with compressed air supplied by an underframe mounted air compressor on the DMDS and MS vehicles only. The compressor runs intermittently, to maintain the required air pressure in the system, powered by a 3-phase brushless motor controlled by unloader valves that open when the working air pressure is available. The compressor is fitted with a twin tower air dryer, which filters and dries the air as it leaves the compressor. Air at 10 bar is stored in the main reservoir located on the MF, MKS and DMS vehicles. An isolating cock and a main reservoir governor are provided to isolate the main reservoir from the main reservoir pipe and to reduce the 10 bar main reservoir pressure down to seven bar. The main reservoir pipe distributes the filtered and dried air.

On all vehicles a choked air supply is taken from the main reservoir pipe via an isolating cock to provide an auxiliary supply for toilets. A further air supply is also taken from the main reservoir pipe to feed the air suspension levelling valves through a venting isolating cock adjacent to each bogie.

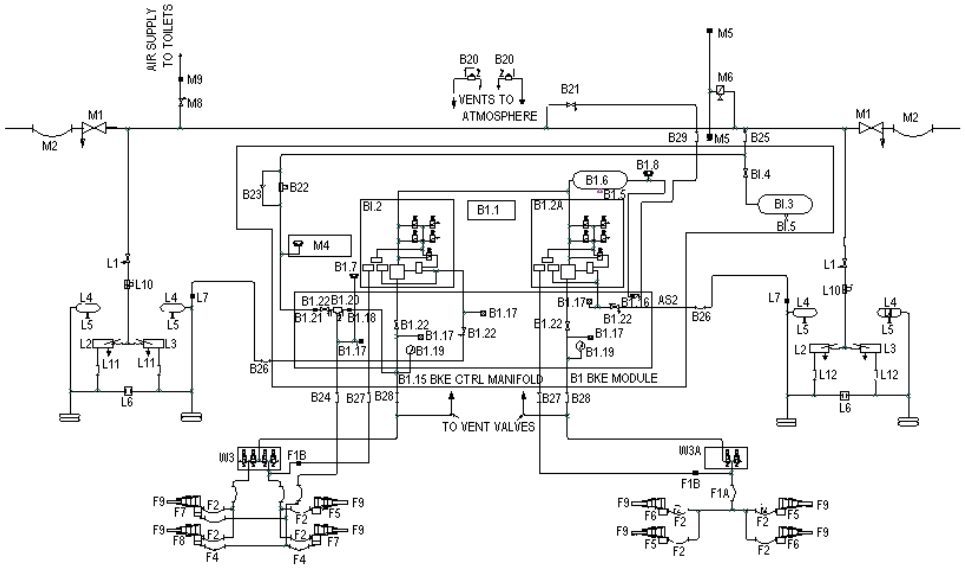
Air Systems
Description and Operation



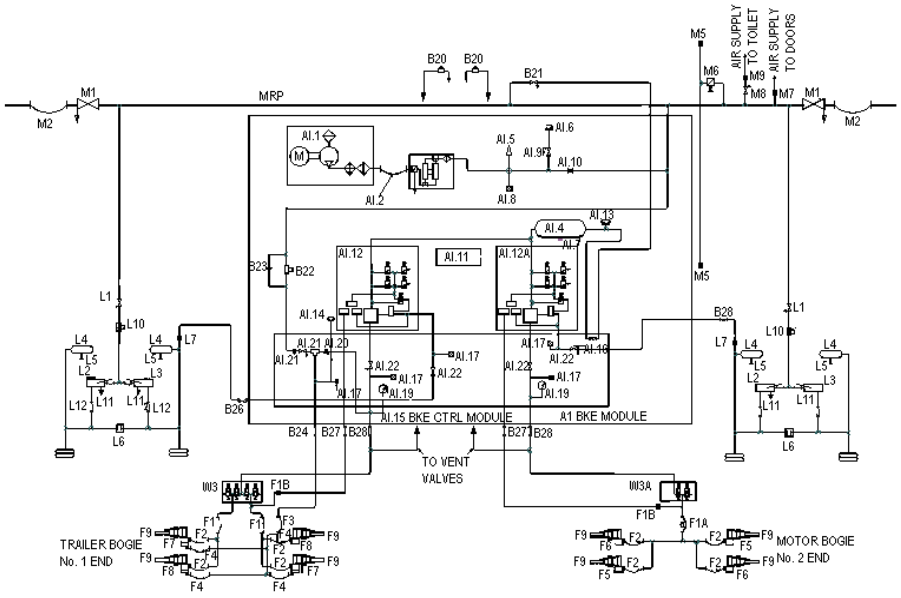
DMDS Car Air Schematic Diagram (Fig.1)

The compressed air from the delivery port is then passed through a high pressure, flexible delivery hose (A1.2) to a twin tower air dryer (A1.3). The flexible hose provides an interface between the resiliently mounted motor/compressor unit and the rigid piping on the module. The resultant dry air from the compressor and air dryer is passed via the main reservoir pipe, to the main reservoir (B1.3), which is mounted on an adjoining car.

Air Systems
Description and Operation



MF and MKS Car Air Schematic Diagram (Fig.2)



MS Car Air Schematic Diagram (Fig.3)

The supply of air to the main reservoir is under the control of a governor (A1.6), which through a contactor, enables the motor/compressor unit to operate on a stop/start duty cycle. When main

Brakes
Description and Operation

ITEM REF.	AIR EQUIPMENT DESCRIPTION	PART NO.	APPLICABLE
A1.7	VENTED DRAIN PLUG	A82089/44	DMDS & MS
A1.8	TEST POINT: 1/4" BSP male	J80841/002	DMDS & MS
A1.9	1/4" ISOLATING COCK	B87248/004	DMDS & MS
A1.10	3/4" ISOLATING COCK	C76928/003	DMDS & MS
A1.11	BRAKE CONTROL UNIT AND WSP CONTROLLER	D85817/008	DMDS & MS
A1.12	ANALOGUE CONTROL UNIT NO 1 END DMDS CAR	E10021/026	DMDS
A1.12a	ANALOGUE CONTROL UNIT NO 2 END DMDS CAR	E10021/027	DMDS
A1.12	ANALOGUE CONTROL UNIT NO 1 END MS CAR	E10021/028	MS
A1.12a	ANALOGUE CONTROL UNIT NO 2 END MS CAR	E10021/029	MS
A1.13	PRESSURE SWITCH (LOW BSR)	B80856/50	DMDS & MS
A1.14	PRESSURE SWITCH (P/B)	B80856/51	DMDS & MS
A1.15	BRAKE CONTROL MANIFOLD - Comprising items A1.16 to A1.22 inclusive	E10027/-	DMDS & MS
A1.16	STRAINER/CHECK VALVE	J75957/9	DMDS & MS
A1.17	TEST POINT	J80841/002	DMDS & MS
A1.18	CHOKE FITTING	A70205/223	DMDS & MS
A1.19	BC. PRESSURE GAUGE	C76435/001	DMDS & MS
A1.20	DOUBLE CHECK VALVE	B81931/007	DMDS & MS
A1.21	CHOKE FITTING	A70205/224	DMDS & MS
A1.22	1/2" ISOLATING COCK	C76893/034	DMDS & MS
	BRAKE FRAME COMPLETE MF CAR	E10050/014	MF
	BRAKE FRAME COMPLETE MKS CAR	E10050/015	MKS
	BRAKE FRAME COMPLETE DMS CAR	E10050/016	DMS
B1.1	BRAKE CONTROL UNIT AND WSP CONTROLLER	D85817/008	MF, MKS & DMS
B1.2	ANALOGUE CONTROL UNIT No. 1 END MF CAR	E10021/038	MF

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ITEM REF.	AIR EQUIPMENT DESCRIPTION	PART NO.	APPLICABLE
B1.2a	ANALOGUE CONTROL UNIT No. 2 END MF CAR	E10021/039	MF
B1.2	ANALOGUE CONTROL UNIT No. 1 END MKS CAR	E10021/040	MKS
B1.2a	ANALOGUE CONTROL UNIT No. 2 END MKS CAR	E10021/041	MKS
B1.2	ANALOGUE CONTROL UNIT No. 1 END DMS CAR	E10021/042	DMS
B1.2a	ANALOGUE CONTROL UNIT No. 2 END DMS CAR	E10021/043	DMS
B1.3	MAIN RESERVOIR (300 Litres)	C77885/005	MF, MKS & DMS
B1.4	MR 3/4" ISOLATING COCK	C76928/003	MF, MKS & DMS
B1.5	MR DRAIN COCK - 1/2" BSP	C76989/002	MF, MKS & DMS
B1.6	BRAKE SUPPLY RESERVOIR (150 Litres)	C77885/006	MF, MKS & DMS
M4	PRESSURE SWITCH (LOW MRG)	B80856/49	MF, MKS & DMS
B1.7	PRESSURE SWITCH (P/B)	B80856/51	MF, MKS & DMS
B1.8	PRESSURE SWITCH (LOW BSR)	B80856/50	MF, MKS & DMS
B1.9	VENTED DRAIN PLUG		
B1.15	BRAKE CONTROL MANIFOLD	E10021/-	MF, MKS & DMS
B1.16	STRAINER/CHECK VALVE	J75957/9	MF, MKS & DMS
B1.17	TEST POINT	J80841/002	MF, MKS & DMS
B1.18	CHOKE FITTING	A70205/223	MF, MKS & DMS
B1.19	BC PRESSURE GAUGE	C76435/001	MF, MKS & DMS
B1.20	DOUBLE CHECK VALVE	B80931/007	MF, MKS & DMS

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ITEM REF.	AIR EQUIPMENT DESCRIPTION	PART NO.	APPLICABLE
B1.21	CHOKE FITTING	A70205/224	MF, MKS & DMS
B1.22	1/2" ISOLATING COCK	C76893/034	MF, MKS & DMS
B20	BC RELEASE VALVE (SALOON MTD.)	B88528/003	ALL
B21	SUPPLY RESERVOIR ISOL. COCK 1/2" BSPP	C76925/001	ALL
B22	PARK. BRAKE REGULATOR (WITHIN BRAKE MODULES)	D78103/002	ALL
B23	PARK. BRAKE BYPASS CHECK VALVE (WITHIN BRAKE MODULES)	J74727/8	ALL
B24	HOSE PARK. BRAKE	B88742/013	ALL
B25	HOSE MAIN RES.	B88742/011	ALL
B26	HOSE AIR SUSPENSION	B88742/010	ALL
B27	HOSE BC TRANSMITTER	B88742/009	ALL
B28	HOSE BRAKE CYLINDER	B88742/008	ALL
B29	HOSE BRAKE SUPPLY RESERVOIR	B88742/007	ALL
	CAB EQUIPMENT		
C1	BRAKE/TRACTION CONTROLLER	D78087/001	DMDS & DMS
C2	NOT USED		
C3	EMERGENCY MR ISOL. COCK 1/2"BSPP	C76925/001	DMDS & DMS
C3a	HORN ISOL. COCK 1/2" BSPP	C76925/002	DMDS & DMS
C4	3-WAY COCK 3/4" BSP	C77938/001	DMDS & DMS
C5	4" DUPLEX PRESSURE GAUGE	C76396/011	DMDS & DMS
C6	HOSE PROTECTION CHOKE	J73566/32	DMDS & DMS
C7	QUICK RELEASE EM. CONNECTOR	J78520/003	DMDS & DMS
C7a	PLUG & CHAIN FOR TEST POINT	J80320/001	DMDS & DMS
C8	EM.MR HOSE CONNECTION	C77038/001	DMDS & DMS
C9	LEVER OPERATED HORN VALVE: 3-WAY, 3 POSITION	C77940/001	DMDS & DMS

Brakes
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ITEM REF.	AIR EQUIPMENT DESCRIPTION	PART NO.	APPLICABLE
C10	NOT USED		
C11	LOW TONE HORN KS1 311 Hz	C76931/020	DMDS & DMS
C12	HIGH TONE HORN KS2 370 Hz	C76931/021	DMDS & DMS
C13	DOUBLE CHECK VALVE	B88534/001	DMDS & DMS
C14	PRESSURE SWITCH (HORN OP.)	B80856/43	DMDS & DMS
C15	AIR FILTER WITH AUTO-DRAIN 1/2" BSP	C76975/034	DMDS & DMS
C16	NOT USED		
C17	FLOW CONTROL VALVE	J79347/003	DMDS & DMS
C18	NOT USED		
C19	NOT USED		
C20	AIR PILOTED SPOOL VALVE	C77917/017	DMDS & DMS
C21	SOLENOID ACTUATED SPOOL VALVE	C77917/019	DMDS & DMS
	ADDITIONAL COMPONENTS FOR THE PNEUMATIC COUPLER/DOOR		
C22	1/4" BSP NON RETURN VALVE	J74727/8	DMDS & DMS
C23	1/4" BSP PNEUMATIC PUSHBUTTON	B88528/003	DMDS & DMS
C24	1.5 mm CHOKE FITTING	J73566/16	DMDS & DMS
	BOGIE MOUNTED BRAKE EQUIPMENT		
F1	BODY/BOGIE HOSE 1/2" X 1000 mm LONG	B88742/014	ALL
F1a	BODY/BOGIE HOSE 3/4" X 1000 mm LONG	B88742/012	ALL
F1b	CHOKE FITTING BC FEEDBACK	J73566/32	ALL
F2	BOGIE/ACTUATOR HOSE		ALL
F3	BOGIE/ACTUATOR HOSE 3/8" 710 mm LONG	B88742/016	ALL
F4	BOGIE/ACTUATOR HOSE (PARK. BRAKE)		ALL
F5	LEFT HAND DISC BRAKE STATION	521450D	ALL
F6	RIGHT HAND DISC BRAKE STATION	521350D	ALL
F7	RIGHT HAND DISC BRAKE STATION WITH PARK. BRAKE	521250D	ALL

Brakes
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ITEM REF.	AIR EQUIPMENT DESCRIPTION	PART NO.	APPLICABLE
F8	LEFT HAND DISC BRAKE STATION WITH PARK. BRAKE	521150D	ALL
F9	BRAKE DISC SET	301800C	ALL
	AIR SUSPENSION		
L1	ISOL. COCK WITH VENT 1/2" BSPP	C76925/001	ALL
L2	LEVELLING VALVE WITH LEVER (RH)	C76155/6	ALL
L2a	LEVELLING VALVE LEVER (supplied part of item L2)	B88545/004	ALL
L3	LEVELLING VALVE WITH LEVER (LH)	C76155/5	ALL
L3a	LEVELLING VALVE LEVER (supplied part of item L3)	B88545/004	ALL
L4	SURGE RESERVOIR No. 1 END MF, MS & MKS CARS	C77885/007	MS, MF & MKS
L4a	SURGE RESERVOIR No. 2 END ALL CARS	C77885/008	ALL
L4b	SURGE RESERVOIR No.1 END DMDS & DMS CARS	C77885/010	DMDS & DMS
L5	DRAIN PLUG	A82089/59	ALL
L6	COMPENSATING VALVE	B80922/5	ALL
L7	CHOKE FITTING	J73566/19	ALL
L8	NOT USED		
L9	NOT USED		
L10	CHARGING VALVE	B81962/107	ALL
L11	HOSE LEVELLING VALVE FEED	B88742/006	ALL
L12	HOSE LEVELLING VALVE RETURN	B88742/005	ALL
	AUXILIARY PNEUMATIC EQUIPMENT		
M1	ISOL. COCK 3/4" BSPP	C76927/001	ALL
M2	INTERCAR HOSE 3/4" BSP X 1115 mm LONG	B88742/017	MF, MS, MKS & DMS
M3	NOT USED		

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ITEM REF.	AIR EQUIPMENT DESCRIPTION	PART NO.	APPLICABLE
M4	PRESSURE SWITCH (LOW MAIN RES.) (WITHIN BRAKE MOD.)	B80856/49	MF, MKS & DMS
M5	TEST POINT 1/2" BSP	J78520/003	ALL
M5a	PLUG & CHAIN FOR TEST POINT	J80320/001	ALL
M6	AIR FILTER WITH AUTO DRAIN 1/2" BSP	C76975/034	ALL
M7	CHOKE (DOOR SUPPLY) 3.2mm	J73566/35	DMDS & DMS
M8	ISOL. COCK 1/2" BSPP WITH VENT (TOILET SUPPLY)	C76925/001	ALL
M9	CHOKE (TOILET SUPPLY) 3.2mm	J73566/35	ALL
M14	HOSE DRUM SWITCH	B88742/018	DMDS & DMS
M15	AUTOCOUPLER HOSE	B88742/019	DMDS & DMS
M16	HOSE DRUM SWITCH	B88742/020	DMDS & DMS
M17	AUTOCOUPLER HOSE	B88742/021	DMDS & DMS
M18	SANDING HOSE	B88742/022	DMDS & DMS
M19	SANDING BOX HOSE (DRYING)	B88742/023	DMDS & DMS
M20	AUTOCOUPLER HOSE	B88742/024	DMDS & DMS
	EMERGENCY RECOVERY EQUIPMENT		
N1	EMERGENCY BRAKE PRESSURE SWITCH	B80856/58	DMDS & DMS
N2	BRAKES RELEASE PRESSURE SWITCH	B80856/59	DMDS & DMS
N3	BRAKE PIPE DUMP VALVE	C77252/004	DMDS & DMS
N4	BRAKE PIPE QUICK RELEASE VALVE	B88733/001	DMDS & DMS
N5	BRAKE PIPE HOSE COUPLING WITH QUICK RELEASE CONNECTION	B72070/28	DMDS & DMS
	WHEELSLIDE PREVENTION EQUIPMENT		
W2	WSP CONTROL UNIT (part of BCU ITEM A1.11		
W3	DUPLEX DUMP VALVE	C77967/006	ALL
W3a	DUMP MAGNET VALVE	C77967/007	ALL

Brakes
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ITEM REF.	AIR EQUIPMENT DESCRIPTION	PART NO.	APPLICABLE
W4	TACHO-ASSEMBLY (including items W4.1 - W4.3)	J80961/009	ALL
W4.1	PICK-UP HEAD (MAGNETIC)		ALL
W4.2	ROTOR		ALL
W4.3	AXLE BOX COVER	D78123/001	ALL

PARKING BRAKE

The parking brake is a spring-applied type, under the control of the pressure in the parking brake pipeline. The parking brake is held in the released condition when the main reservoir (MR) pipe pressure is applied to the parking brake cylinders.

When the MR pipe pressure falls, parking brakes are applied by springs pressure. Each parking brake actuator has a manual release handle, by which that parking brake may be released from the trackside.

The air supply for the parking brake is taken from the MR pipe through a protective choke this prevents sudden loss of MR pipe pressure in the event of hose rupture, an isolating cock and an anti-compound double check valve.

A pressure switch monitors the line, and indicates to the driver when the parking brake is released. A test point allows the pressure to be checked.

This double check valve is also connected into the brake cylinder airline, and prevents both the brake actuators and the parking brake being applied at the same time.

BRAKE BLENDING

Each drive car transmission unit is equipped with a hydrodynamic brake retarder controlled by and used in conjunction with the electronic/pneumatic friction brake.

The control system combining the friction and electrical dynamic brake on each car is known as "continuous blending".

The system incorporates a brake sharing scheme whereby the dynamic brake on the drive bogie is used up to the limit of its capacity without the application of the friction brake on either the motor or trailer bogie. If the brake demand exceeds the dynamic brake capability then the control equipment applies the friction brake, firstly to the trailer bogie up to the maximum level for that vehicle, then secondly to the drive bogie to complement the dynamic brake on that bogie.

Brakes
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The main item of blending control is the electronic BCU, one of which is provided on each car. This unit receives the brake demand and suspension load signals and provides an output signal for the ACU application and release magnet valves.

On each car, the BCU provides a "retarder demand" signal to the traction control equipment and receives from that equipment a "retarder achieved" signal.

At low speeds, the dynamic brake loses its effectiveness, and as this point is approached, the traction control equipment send a "begin to fade" signal to the BCU.

The BCU responds by increasing the friction brake application, ensuring a smooth blend into full friction brake application as the train comes to a stand.

The BCU also supplies a load signal to the traction control equipment, where it is used to control the traction demand, helping prevent wheel slip.

A microprocessor within the brake control unit detects wheel slide and corrects by controlling the brake effort. To do this there is a speed probe mounted on each axle of the trailer bogie and one probe on the drive bogie, which is used to monitor the wheel speed.

Bogie mounted duplex dump valves control the brake effort once a slide has been detected.

BRAKE MODULES

Brake modules are fitted to the underframe of all vehicles in the train. Brake modules are of two types: A1 modules fitted to DMDS car and B1 modules fitted to MS and DMS cars.

A1 modules (brake and air supply / battery modules) comprise a welded frame assembly on which is mounted the air compressor and air dryer and many of the components of the brake control system - the brake control unit (BCU), the analogue control unit (ACU), the brake supply reservoir (BSR), brake control manifold and ancillary items such as isolating cocks.

B1 modules (brake and main reservoir / battery modules) comprise a welded frame assembly on which is mounted many of the components of the brake control system - the brake control unit (BCU), the analogue control unit (ACU), the brake supply reservoir (BSR), brake control manifold and ancillary items such as isolating cocks.

Other components of the brake control system are mounted in the cab (e.g. the power/brake controller) and the saloon (e.g. the brake cylinder release valve, B20).

Brakes
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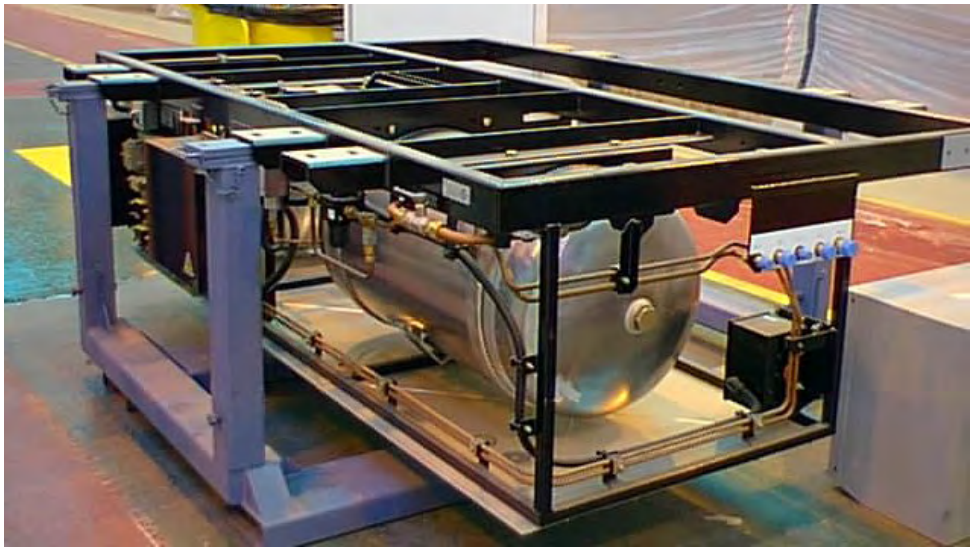
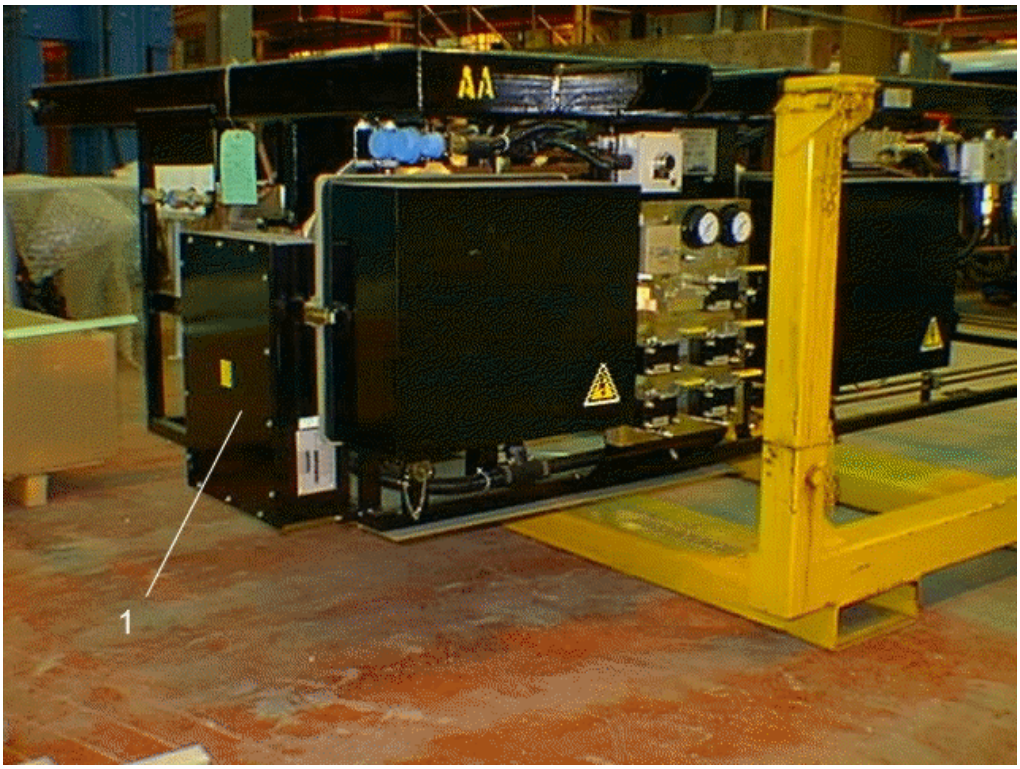
Brake Module (A1) (Fig. 5)



Brake Module (B1) (Fig.6)

Brakes
Description and Operation

BRAKE CONTROL EQUIPMENT



Brake Control Unit (Fig.7)

General Operation

The BCU (1) will provide all the local service control of the pneumatic brake including variation of the pressure with demand, variation of the pressure with car load.

Wheelslide detection is provided to detect wheel slide and correction by controlling the brake effort. To do this there is a speed probe mounted on each axle of the trailer bogie and one probe on the power bogie, which is used to monitor the wheel speed.

Bogie mounted duplex dump valves control the brake effort once a slide has been detected.

If a hydrodynamic brake is available, the brake control unit will provide the interfacing required to blend the pneumatic and hydrodynamic brakes, to provide an integrated brake system.

The forced release facility provides a means of releasing the service brake in the event of the loss of the brake release mode wire.