



SD40

LOCOMOTIVE

SERVICE MANUAL

Revision E

SERVICE DEPARTMENT

Electro-Motive Division GM



La Grange, Illinois

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FOREWORD

This manual covers mechanical and electrical maintenance. Its purpose is to provide instructions for what may be called "on-the-locomotive" maintenance, along with instructions for testing and adjustment of systems. It will also serve to relieve the locomotive operating manual of detail and to provide under separate cover material for general familiarization with locomotive components and systems.

Instructions for maintenance that requires deep involvement with component repair, or instructions for rework that involves use of bench apparatus, continues to be presented in the standard EMD Maintenance Instruction form. Instructions covering the diesel engine appear in the EMD Engine Maintenance manual. Certain engine mounted equipment may receive brief mention in this locomotive service manual, but information in the engine maintenance manual covering such equipment takes precedence.

SERVICE DATA PAGES

A Service Data page is included at the back of each section of the Locomotive Service manual. This page provides the following:

1. Reference to applicable Maintenance Instructions.
2. Reference to applicable replacement part numbers.
3. Reference to component manufacturer's technical literature.
4. Reference to applicable tool and testing apparatus numbers.
5. Reference to instruction file numbers for customer manufacture of testing apparatus.
6. Specific system values for operation or testing.



LOCOMOTIVE

SERVICE MANUAL

SD40 GENERAL INFORMATION

Model Designation	SD40	
Locomotive Type	(C-C) 0660	
Locomotive Horsepower	3000	
Diesel Engine		
Model	645E3	
Number Of Cylinders	16	
Cylinder Arrangement	45° "V"	
Cylinder Bore And Stroke	9-1/16" x 10"	
Operating Principle	2 Stroke Cycle, Turbocharged, Unit Injection, Water Cooled	
Full Speed	900 RPM	
Idle Speed	315 RPM	
Main Generator Model		AR10-D14
Traction Alternator (Rectified Output)		AR10
Number Of Poles		10
Nominal Voltage (DC)		600
Frequency (at 900 RPM)		75 cps
Companion Alternator		D14
Nominal Voltage (AC)		215
Number Of Poles		16
Frequency (at 900 RPM)		120 cps
Auxiliary Generator		
Voltage (DC)		74
Rating		10 KW 74
Traction Motors		
Model		D77
Number		6
Type		DC, Series Wound, Axle Hung
Driving Wheels		
Number		6
Pair Diameter		40"
Tread		Tapered

Curve Negotiation

Truck swing limits single unit curve negotiation to a 30° or 193 ft. radius curve.

Single unit coupled to a 50 ft. car is limited by car coupler swing to a 17° or 338 ft. radius curve.

Two (2) units coupled in multiple limited by foot boards to a 23° or 250 ft. radius curve.

SD40 GENERAL INFORMATION (CONT'D)

Maximum Speed Options With Gear Ratio

Gear Ratio	*Top Speed MPH
62:15	65
61:16	70
60:17	76
59:18	82
58:19	88

*Based on rated RPM of traction motors.

Air Brakes Type 26L

Air Compressor

Type 2 Stage
 Number Of Cylinders 3
 Capacity (at 900 RPM). 254 Cu. Ft./Min.
 Air Compressor Cooling Water
 Lube Oil Capacity 10-1/2 Gal.

Storage Battery

Number Of Cells 32
 Voltage 64
 Rating (8 Hour) 420 Amp. Hr.

Supplies

Lube Oil Capacity
 Basic Oil Pan 243 Gal.
 Increased Capacity Oil Pan 395 Gal.

Usable Oil

Basic Oil Pan 47 Gal.
 Increased Capacity Oil Pan 195 Gal.

Fuel Tank Capacity

Basic 3200 Gal.
 Modifications 4000 Gal.
 3600 Gal.
 2600 Gal.
 1700 Gal.

SDP Fuel And Water Combination Divided As Desired By The Railroad.

Cooling Water Capacity 254 Gal.

Sand 56 Cu. Ft.

Major Dimensions

Distance, pulling face of coupler to centerline of truck. 12' 10"
 Distance between bolster centers 40' 0"
 Truck - Rigid wheel base 13' 7"
 Distance, pulling face front coupler to rear coupler 65' 8"
 Width over cab sheeting 10' 0"
 Width over grab irons 10' 3-1/8"
 Height, top of rail to top of cooling fan guard 15' 7-3/16"
 Width over basic arm rests 10' 4"
 Approximate Weight On Rails 368,000 lbs.
 Weight On Drivers 100%

SD40 GENERAL INFORMATION (CONT'D)

WEIGHTS

The weights as listed below are approximate and are intended as an aid in determining the handling procedure to be used. Weights represent lbs. per unit as described.

16-645E3 Diesel Engine	32,500
Starter Motor	80
Starter Motor Bracket	60
Engine Governor	120
Turbocharger	1800
AR10 Main Generator Assembly	18,000
Engine Air Filter Oil-Type	917
Inertial Air Filter	600
Inertial Filter Screen	35
Inertial Filter Compartment And Hatch	4700
Inertial Filter Hatch (Less Filters)	500
Fuel Tank 3200 Gal.	6650
Fuel Tank 4000 Gal.	9940
Truck Assembly	56,000
Traction Motor	6000
Axle	4150
Wheel	1015
Gear 62 Tooth	409
Bearing - Inner Race	33
Air Compressor	2325
Air Compressor Shaft	136
Air Compressor Shaft Guard	68
Air Compressor Coupling	48
Lube Oil Cooler	845
Lube Oil Filter	675
Fuel Pump Assembly	81
Fuel Suction Strainer	8
AC Cabinet Assembly	253
Fuel Filter	60
Temperature Switch Manifold	20
Load Regulator Vane Motor	36
Dynamic Brake Fan Assembly	760
Dynamic Brake Resistor Grid	385
Dynamic Brake Grid Shorting Contactor	35
Fan Grill Assembly	190
Radiator Fan Assembly	700
Radiator Core	325
Cab Heater	71
Storage Battery	289
SCR (Generator Excitation)	29
Resistor Motor Field Shunting	54
Power Contactor	30
Reversing Switch	35
Motor Field Shunting Contactor	26

SD40 GENERAL INFORMATION (CONT'D)

GENERAL LEGEND OF ELECTRICAL REFERENCE DESIGNATIONS

In the following general legend of reference designations, the long dash "-" means that a numeral or numerals will appear when the designation is used in a specific wiring diagram. The symbols appear in alpha/numeric order with letters of the alphabet taking first position followed by numerals (represented by the long dash "-").

AC-	Cooling Fan Contactor	FLT	Field Loop Transducer
AGR	Automatic Ground Reset	FLX	Field Loop Auxiliary Relay
AV,BV,CV,DV	Governor Speed Setting Solenoids	FLY	Field Loop Auxiliary Relay
AVR,BVR,CVR	Throttle Response Contactors	FOR	Forward Relay
AWS	Auxiliary Wheel Slide Relay BBrake	FPC	Fuel Pump Contactor
	Power Contactor	FPCR	Fuel Pump Contactor Relay
BCT	Brake Current Transducer	FPR	Fuel Pump Relay
BF	Battery Field Contactor	FSA	Field Shunt Auxiliary Relay
BFA	Battery Field Auxiliary Relay	FSC	Field Shunt Control Relay
BKBL	Dynamic Brake Grid Blower Motor	FSD	Field Shunt Delay Relay
BPR	Brake Positioner Relay	FS-	Field Shunt Contactor
BPS	Brake Program Switch	FTR	Forward Transition Relay
BR	Brake Relay	FTRA	Forward Transition Auxiliary Relay
BTR	Backward Transition Relay	FTX	Forward Transition Auxiliary Relay
BWA	Brake Warning Auxiliary Relay	FVS	Filter Vacuum Switch
BWR	Brake Warning Relay	GCR	Generator Current Relay
BX	Brake Power Auxiliary Relay	GCT	Generator Current Transducer
B-	Brake Transfer Switches	GDL	Ground Detection Light Relay
CCR	Compressor Control Relay	GF	Generator Field Contactor
COLR	Cutout Limit Relay (Generator Current Limit)	GFA	Generator Field Auxiliary Contactor
		GFD	Generator Field Decay Contactor
COR	Motor Cutout Relay	GFR	Generator Field Relay
CORX	Motor Cutout Auxiliary Relay	GPT	Generator Potential Transformer
CRL	Compressor Relay	GR	Ground Relay
CRBC	Battery Charging Rectifier	GS	Generator (Engine) Start Contactor
CRFPC	Fuel Pump Contactor Delay Rectifier	GSA	Generator (Engine) Start Auxiliary Relay
CRGR	Ground Relay Rectifier		
DBR	Dynamic Brake Regulator	GVT	Generator Voltage Transducer
DRR	Decrease Resistance Relay	GV-	Main Generator Voltage Regulator Module
D-	Dynamic Grid Shorting Contactor	GX-	Main Generator Field Current Regulator Module
EBT	Electro Thermal Blowdown Timer	IPS	Independent Brake Pressure Switch
EFCO	Emergency Fuel Cutoff Switch	I RR	Increase Resistance Relay
EFL	Engine Filter Light Relay	IS	Isolation Switch
EL	Excitation Limit Light Relay	ISA	Isolation Switch Auxiliary Relay
ELD	Excitation Limit Delay Relay	LOR	Lockout Relay
ELR	Excitation Limit Relay	LOS	Low Oil Switch
ER	Engine Run Relay	LOTR	Lube Oil Transfer Contactor
ESS	Emergency Sanding Switch	LR	Load Regulator
ETS	Engine Temperature Switch	LRP	Load Regulator Positioner
FCT	Field Current Transducer	MCO-	Motor Cutout Relay
FL	Field Loop Contactor		
FLC	Field Loop Control Relay		

SD40 GENERAL INFORMATION (CONT'D)

MFP	Motor Field Protection Relay	SCC	Series Connecting Contactor (Battery
MFT	Motor Field Current Transducer	Field)	
MSSF,MSSR	Manual Sanding Switch - Forward -	SCR	Controlled Rectifier - Generator Excitation
Reverse (Pressure Switch Actuated By Remote Valve)		SEN	Sensor - SCR Trigger
MVCC	Magnet Valve - Compressor Control	SF	Shunt Field Contactor
MV-	Magnet Valve - Reservoir Or Filter	SFT	Shunt Field Transfer Relay
Blowdown		SHS-	Selector Handle Cam Operated Switches
MVDBI	Magnet Valve - Dynamic Brake Interlock	SP-	Series-Parallel Power Contactor
MVOS	Magnet Valve - Train Overspeed	ST-	Starter Solenoid Contacts
MVSF	Magnet Valve - Sanding Forward	SSS	Service Selector Switch
MVSH	Magnet Valve - Shutter Control	SS-	Sequence Stepping Relay Transition
MVSR	Magnet Valve - Sanding Reverse	STS	Shutter Temperature Switch
MWVC	Magnet Valve - Water Cooler	SWO	Simultaneous Wheel Overspeed Relay
M-	Motor Power Switchgear	S-	Series Power Contactor
NVR	No (AC) Voltage Relay	S-	Sequence Relay-Transition
OCL	Overcurrent Lockout Relay (Dynamic	S-A	Series Power Contactor Auxiliary Relay
Brakes)		T	Transformer
OCP	Open Grid Circuit Protection Relay	TA,TB,TC	Fan Control Temperature Switches
ORS	Overriding Solenoid	TCR	Train Control Relay
OSR	Overspeed Relay	TCR	Temperature Compensating Relay
OVR	Overvoltage Relay	TDF	Slip Control Timing Relay (Time Delay
PCP	Performance Control Panel	Generator Field)	
PCR	Pneumatic Control Relay	TDLO	Time Delay - Lube Oil Transfer
PCs	Pneumatic Control Switch	TDO	Slip Control Timing Relay (Time Delay
PFS	Parallel Field Shunt Relay	Overriding Solenoid)	
POT	Brake Potential Relay	TDP	Time Delay Positioner Relay
PR	Parallel Relay	TDR	Transition Delay Relay
PRA	Parallel Relay Auxiliary	TDS	Time Delay Sanding Relay
P-	Power Contactor - Parallel	THS-	Throttle Controlled Cam Switches
QS	Transistorized Switch	TLPC	Turbo Lube Pump Contactor
RCP	Rate Control Panel	TLTD	Turbo Lube Time Delay Relay
REBC	Battery Charging Resistor	TRP	Throttle Response Panel
REDB	Dynamic Brake Rheostat/ Resistor	TST	Transition Sequence Test Switch
REFS	Resistor - Motor Field Shunt	T-	Transformer
REGID	Dynamic Brake Resistor	VR	Voltage Regulator
REMFS	Resistor - Motor Field Shunt	WCR	Wheel Creep Relay
RER	Reverse Relay	WL	Wheel Slip Light Relay
RVF	Direction Transfer Switch - Forward	WS	Wheel Slip Relay
RVR	Direction Transfer Switch - Reverse	WSC	IDAC Wheel Slip Control Panel
RVRA	Reverser Switch Auxiliary Relay	WSR	Wheel Slip Relay /Wheel Speed Relay
SBP	Sensor Bypass Panel	WST-	Wheel Slip Transducer
SCC	Starting Current Contactor	WS-	Wheel Slip Relay
		Z-	Zener Diode