NOTE

These data sheets are provided as a service to members, particularly for repairing and overhauling existing models. Many of the motors and gearboxes are no longer commercially available, and suppliers' details may not be current.

MOTOR AND GEARBOX DATA SHEETS

The data sheets that follow contain full size drawings of various motors and gearboxes available from the model trade.

Wherever possible the data supplied is taken from the manufacturers' own specification sheets. Where no specification is available the information has been obtained by bench testing carried out on behalf of the Gauge 'O' Guild by the Technical Committee. Although not as precise as the manufacturers' tests they are sufficiently accurate for model locomotive calculations.

Notes on the data supplied

Nominal voltage and no-load speed.

Nominal voltage is the voltage applied at the motor terminals during testing. The no load speed figure quoted is the speed achieved at this voltage. Unless otherwise stated it is safe to operate the motor at a higher voltage provided the limitations described in Part A, Sections 2.b and 2.c are observed. For instance, where a motor/gear-box combination is shown to be suitable for mixed traffic duties, operation at a higher voltage could make it suitable for express passenger duty.

Stall current and maximum recommended current

Some manufacturers' specification sheets contain a figure for the maximum recommended current. Where no recommendation has been included a good rule of thumb is to limit the maximum current to about 80% of the stall current figure quoted. This maximum current figure should be used to determine the size of fuse fitted to the locomotive. This point is of particular importance where low current motors are in use, as explained in Sections 2.b 2.c and 5.d.

Stall torque and stall tractive effort

Throughout the notes and data sheets the units used to measure torque are gram-centimetres and the units for tractive effort are grams. Some manufacturers' specification sheets quote the motor torque values in ounce-inches or fractions of a Newton-metre. The following factors were used to convert into gram-centimetres.

Ounce-inches (oz-in)	multiply by	72.0
milliNewtonmetres (mNm)	multiply by	10.193
Newtonmetres/10000 ($Nmx10^{-4}$)	multiply by	1.0193

The answers in gram-centimetres can then be used in tractive effort calculations.

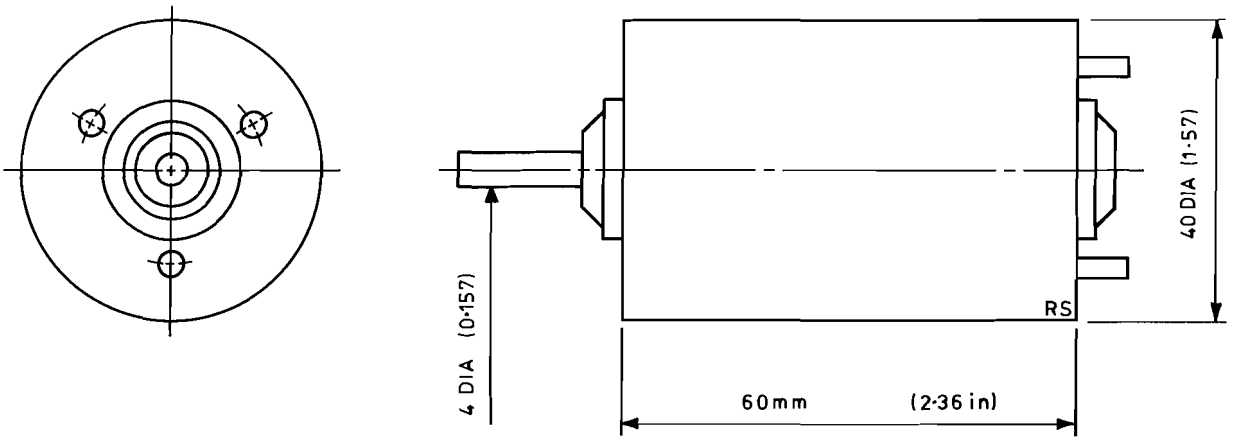
Motor 1 - BUHLER 13.40 E3-A. Drg 1 9/85

DC permanent magnet motor manufactured by Buhler, Nuremburg, W. Germany.

5-pole armature - Carbon brushes. Self-lubricating and self-aligning bronze bearings. Nominal voltage - 12 volts. No load speed - 6500 rpm. Stalled current - 6.9 amps. Stalled torque - 1230 gram cm.

Data source: Guild bench test.

Available from Kingfisher Models, 44 Majorie Road, Chaddesden, Derby, DE2 4HN.



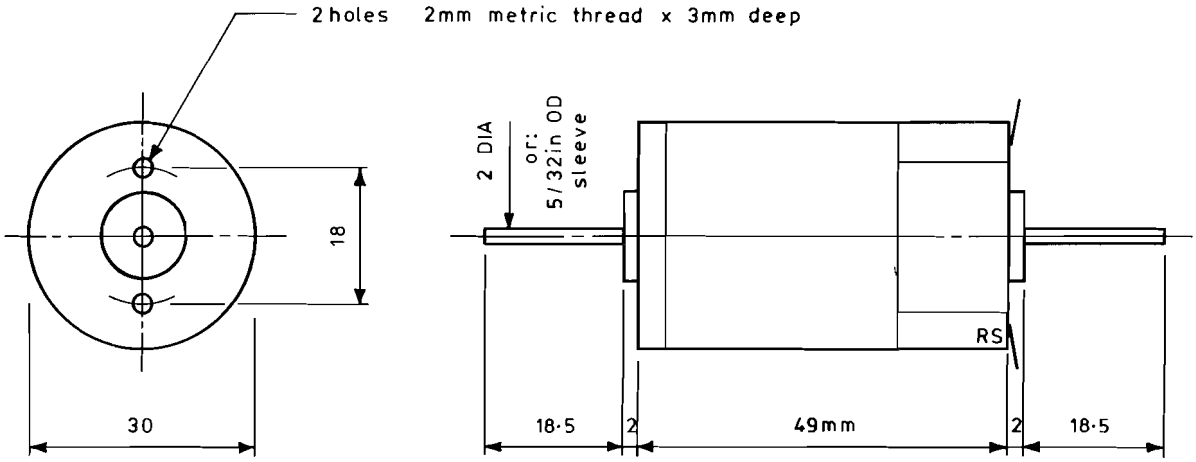
Motor 2a - CRAILCREST E3-A Drg 2a 9/85

DC permanent magnet motor manufactured by Buhler, Nuremburg, West Germany.

5-pole armature - Carbon brushes. Self lubricating - self aligning bronze bearings. Nominal voltage - 12 volts. No load speed - 6240 rpm. Stalled current - 1.6 amps. Stalled torque - 325 gram cm.

Data source: Guild bench test.

Available from MSC Models Ltd, 1 Malvern Road, Hampton, Middlesex TW12 2LN, or their agents.



Motor 2b - MSC 14:1 Gearbox E3-A. Drg 2b 9/85

Shown fitted to a Crailcrest motor.

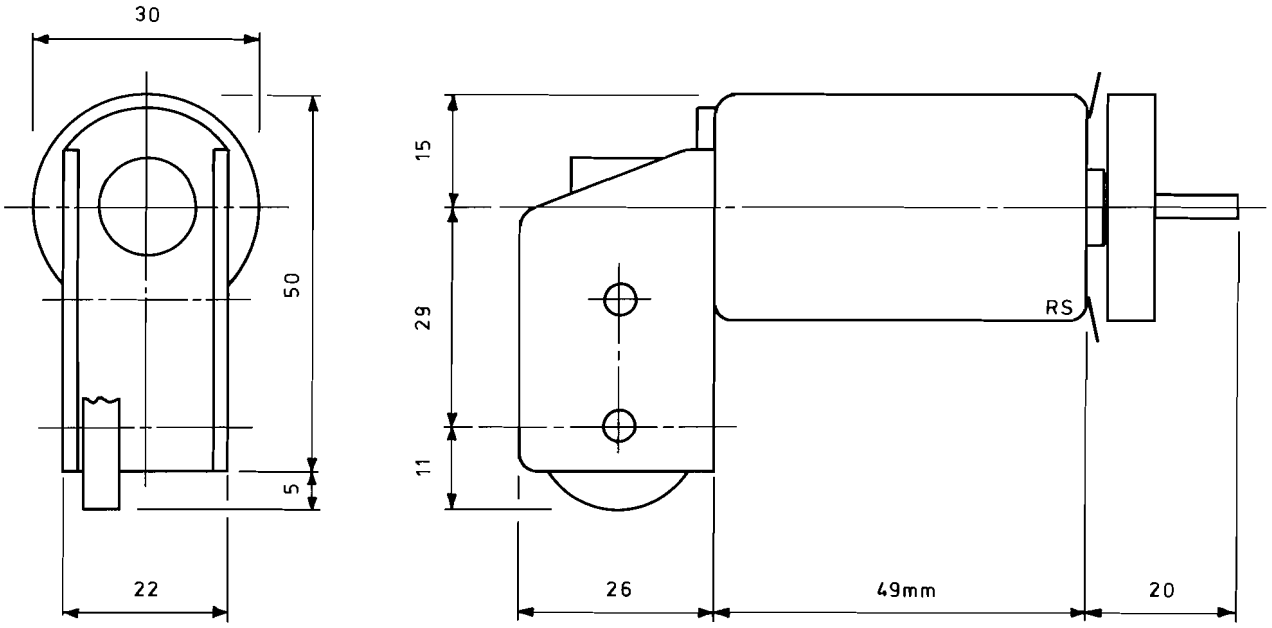
Motor details : Nominal voltage - 12 volts. No load Speed - 6420 rpm. Stalled current - 1.6 amps. Stalled torque - 325 gram cm.

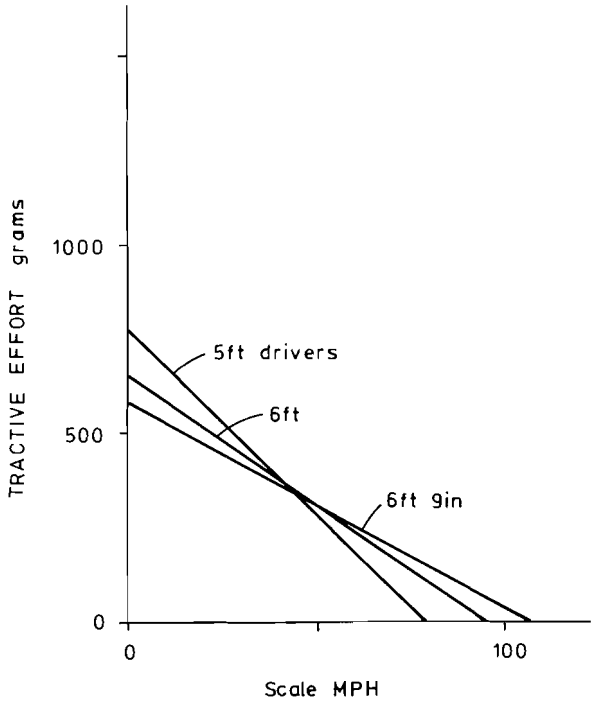
Gearbox : Efficiency 30% (Worm end thrust taken by motor bearings). Driving axle speed 446 rpm.

Comment : This combination of motor and gearbox gives adequate haulage capacity and speed range for mixed traffic and express locomotives.

Data source: Guild bench test.

Available from MSC Models Ltd, 1 Malvern Road, Hampton, Middlesex TW12 2LN.





Motor 2c - MSC 24:1 Gearbox E3-A. Drg 2c 9/85

Shown fitted to a Crailcrest motor.

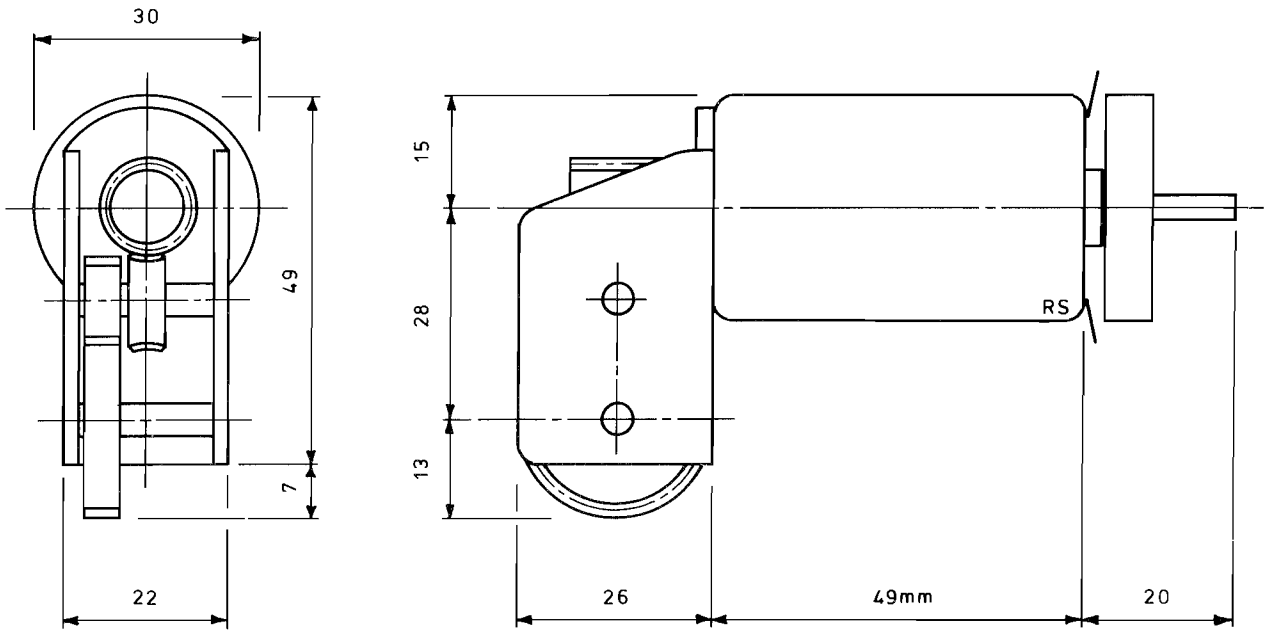
Motor details: Nominal voltage - 12 volts. No load speed - 6240 rpm. Stalledcurrent - 1.6 amps. Stalled torque - 325 gram cm.

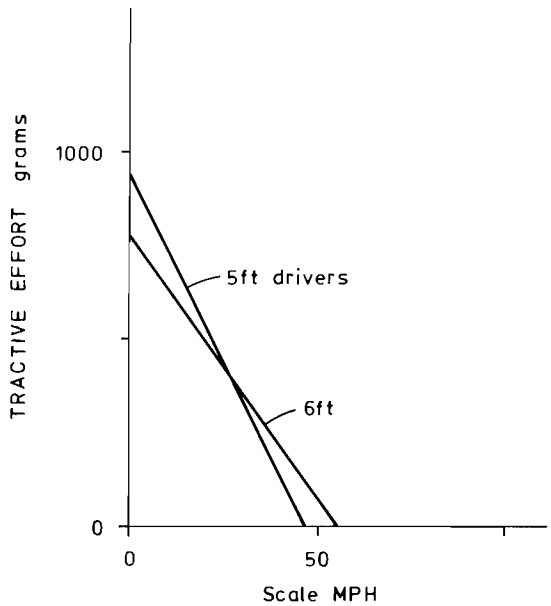
Gearbox: Efficiency - 21% (Worm end thrust taken by motor bearings). Driving axle speed - 260 rpm.

Comment: This combination of motor and gearbox gives a relatively low top speed but a good tractive effort. Suitable for most of the medium to large freight locomotives.

Data source: Guild bench test.

Available from MSC Models Ltd, 1 Malvern Road, Hampton, Middlesex TW12 2LN.





Motor 2d - MSC 33.3:1 Gearbox

Shown fitted to a Crailcrest motor.

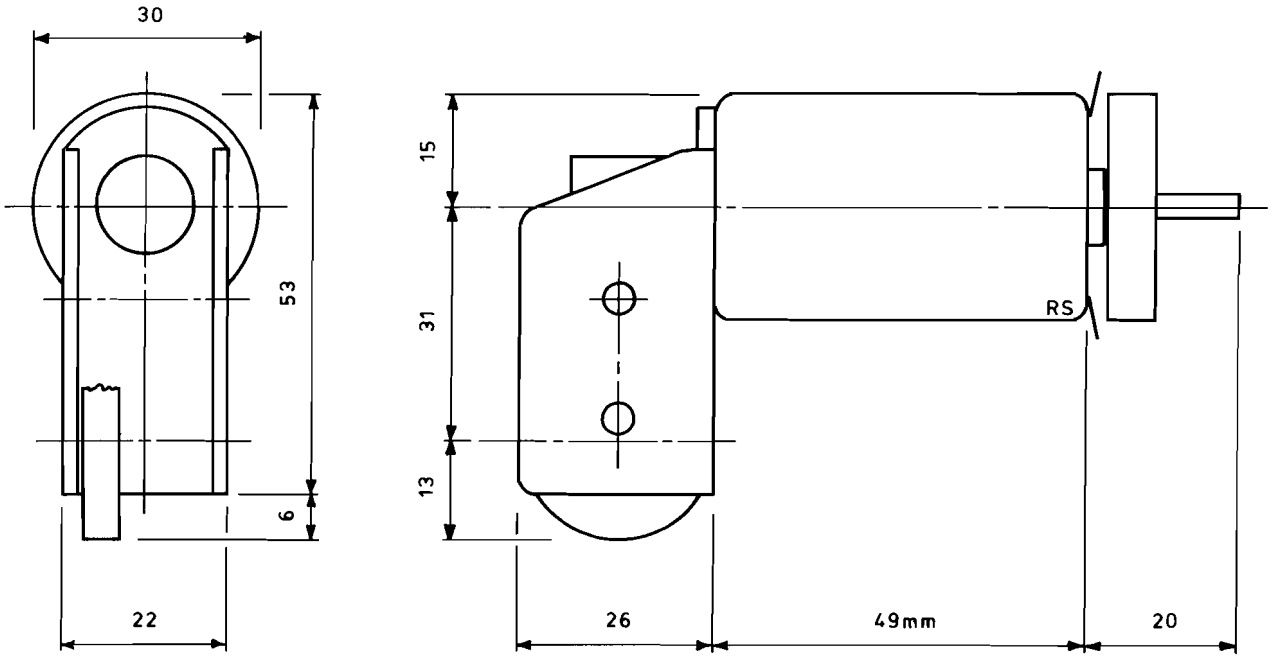
Motor details: Nominal voltage - 12 volts. No load speed - 6240 rpm. Stalled current - 1.6 amps. Stalled torque - 325 gram cm.

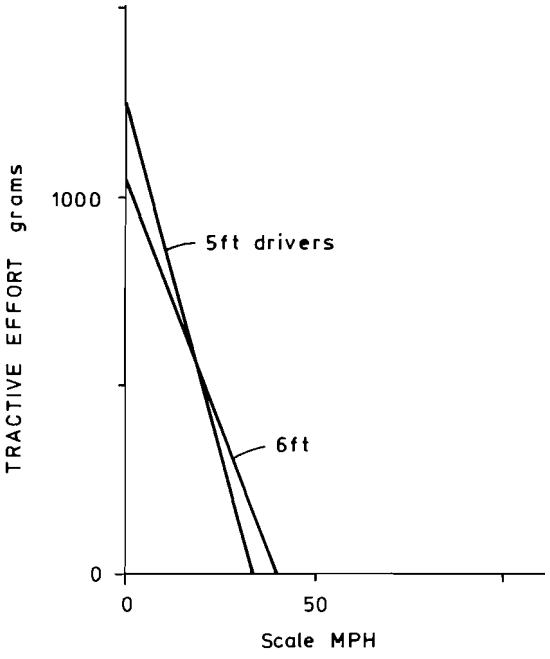
Gearbox: Efficiency - 20% (Worm end thrust taken by motor bearings). Driving axle speed - 187 rpm.

Comment: This combination of motor and gearbox gives a low top speed but a high tractive effort suitable for the most powerful freight locomotives.

Data Source: Guild Bench test.

Available from MSC Models Ltd, 1 Malvern Road, Hampton, Middlesex TW12 2LN.





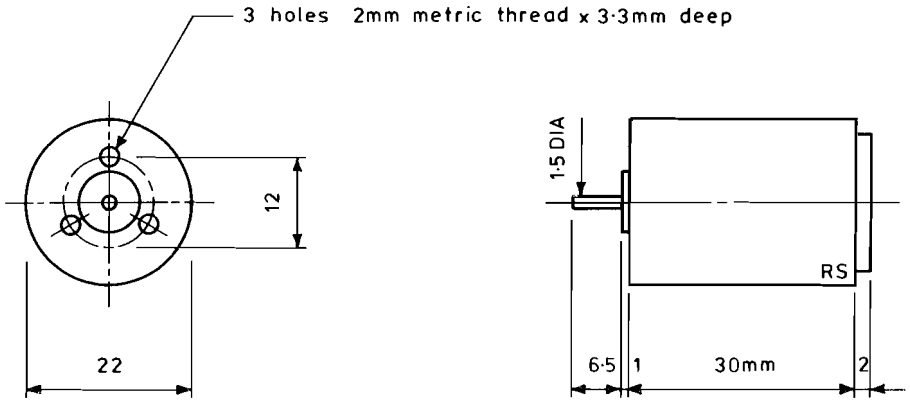
Motor 3a - ESCAP 22C11 - 210E

DC permanent magnet motor manufactured by Portescap, Switzerland.

Ironless rotor with skew winding. 5 segment commutator with precious metal brush gear. Self lubricating sintered bearings. Nominal voltage - 12 volts. No load speed - 7300 rpm. Stalled current - 0.57 amps. Stalled torque - 91 gram cm. Maximum recommended continuous current 0.35 amps. Slow blow fuse supplied rated at 0.35 amps.

Data source: Manufacturer's data sheets.

Available from Portescap (UK) Ltd, 204 Elgar Road, Reading, RG2 ODD.



Motor 3b - RG7 E3-A. Drg 3b 9/85

Manufactured by Portescap.

Supplied fitted with an Escap 22C11-21OE motor.

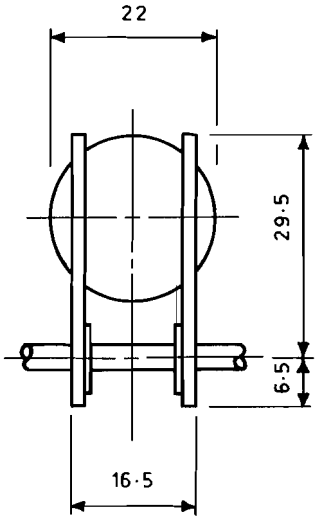
Motor details: Nominal voltage - 12 volts. No load speed - ~~7800~~ 7300 rpm. Stalled current - 0.57 amps. Stalled torque - 91 gram cm. Maximum recommended current - 0.35 amps (Slow-blow fuse supplied).

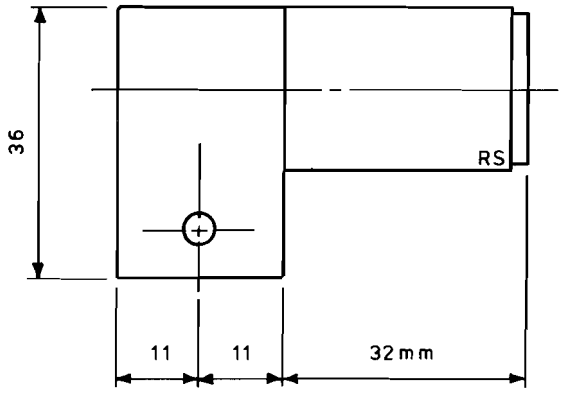
Gearbox details: Bevel and spur reduction box available in two ratios - 31.2:1 and 23.1:1. Overall efficiency - 66%. Driving axle speeds 31.2:1 - 250 rpm; 23.1:1 - 338 rpm.

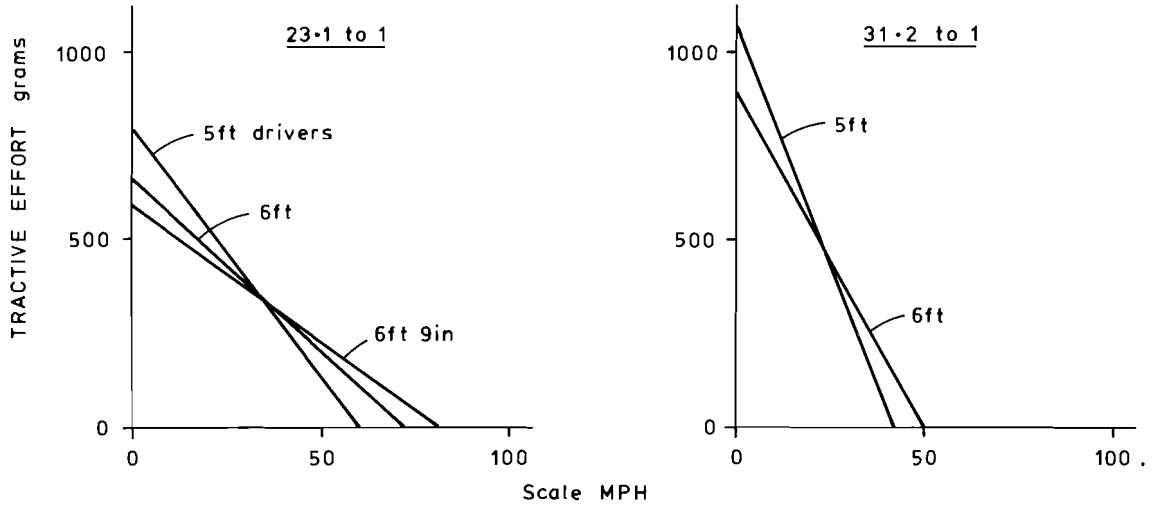
Comment: The 23.1:1 gearbox has a good haulage capacity and speed range for most locomotive types. The 31.2:1 gearbox has a low top speed but a high tractive effort suitable for the most powerful freight locomotives.

Data source: Manufacturer's data sheets.

Available from Portescap (UK) Ltd, 204 Elgar Road, Reading, RG2 0DD.







Motor 4a - ESCAP 34L11 - 219E and 222E

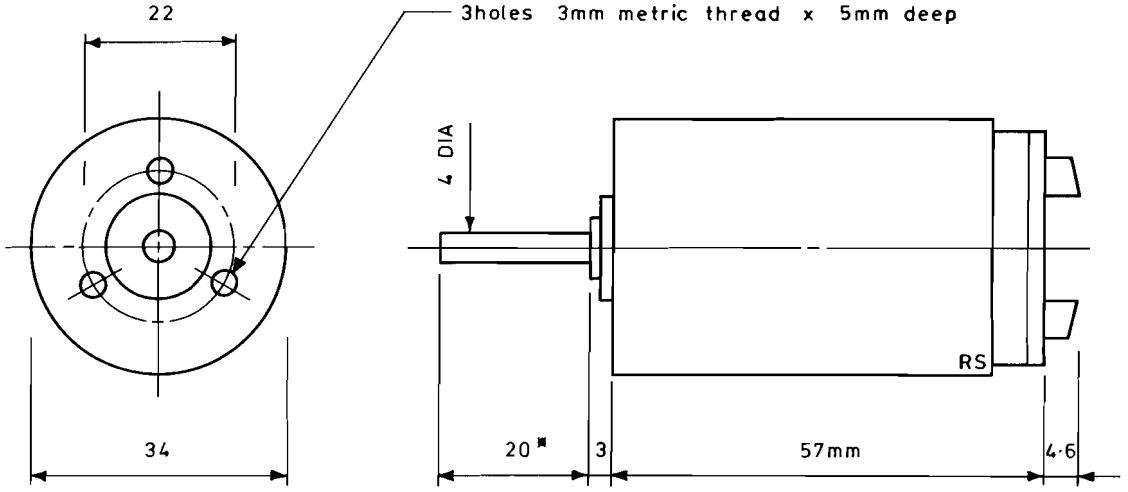
DC permanent magnet motors manufactured by Portescap, Switzerland.

Ironless rotors with skew windings. 5 segment commutators with precious metal brushgear. 219E has sealed ball bearings. 222E has self-lubricating sintered bearings.

	219E	222E
Nominal voltage	24 volts	18 volts
No load speed	5400 rpm	5100 rpm
Stalled current	1.5 amps	2.0 amps
Maximum recommended continuous current	0.8 amps	1.0 amps
Stalled torque	1080 gm cm	1066 gm cm

Data source: Manufacturer's data sheets.

Available from B. McIntee, Stanmore, Middx.



* shaft length 6mm on type 222E motor

Motor 4b - MSC 14:1 Gearbox with adaptor to fit ESCAP 34L11 - 219E

E3-A. Drg 4b 9/85

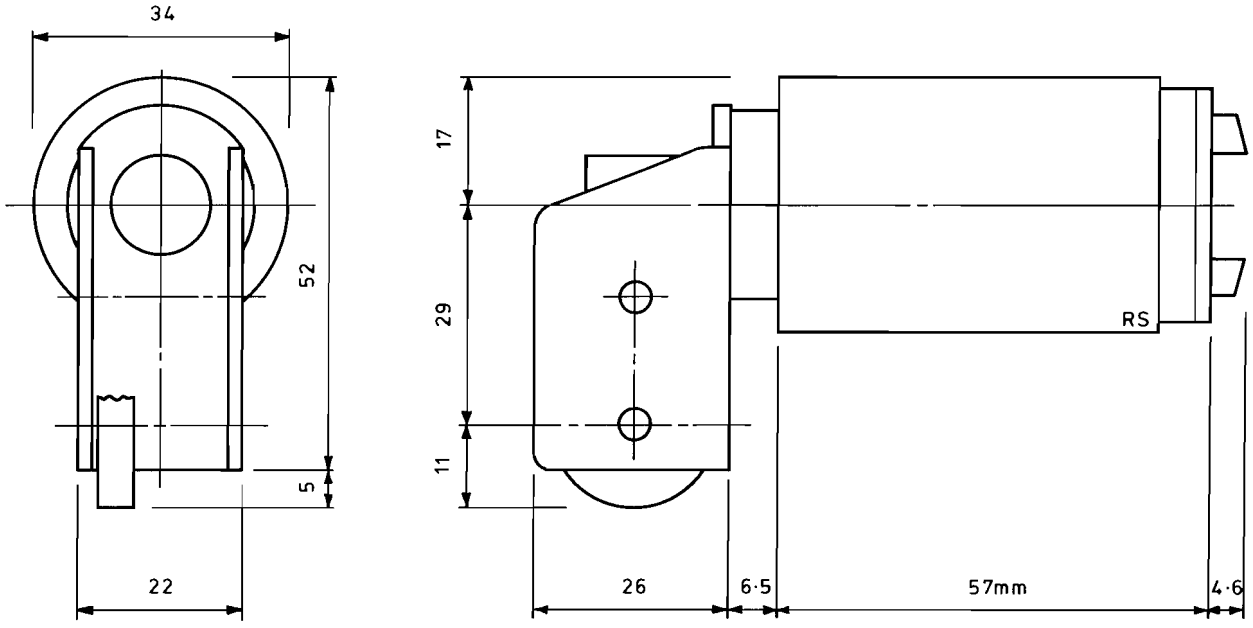
Motor details: Nominal voltage - 24 volts. No load speed - 5400 rpm. Stalled current - 1.5 amps. Stalled torque - 1080 gram cm. Maximum recommended continuous current - 0.8 amps.

Gearbox: Efficiency - 40% (Worm end thrust taken by ball races). Driving axle speed - 385 rpm.

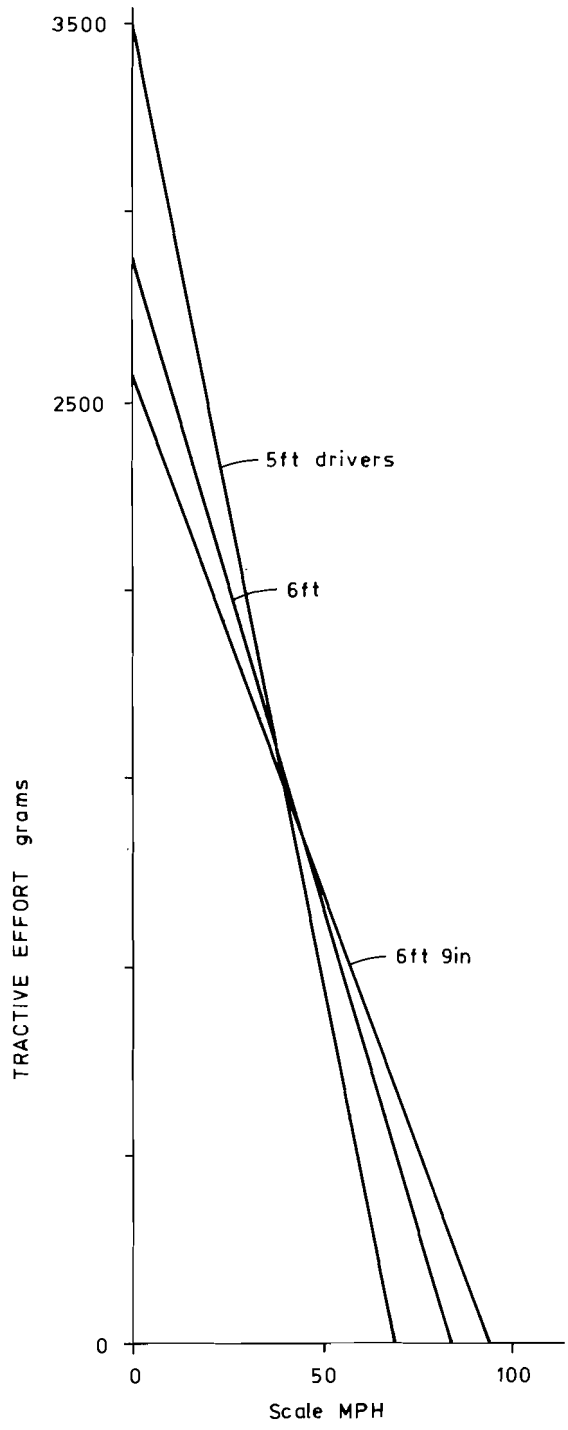
Comment: This combination gives an exceptionally high tractive effort together with a good speed range suitable for all classes of locomotive.

Data source: Manufacturer's data sheets.

Available from B McIntee, 135 Old Church Lane, Stanmore, Middlesex HA7 2RT.



SEE REVERSE FOR GRAPH


3500
2500
0
TRACTIVE EFFORT grams
5ft drivers
6ft
6ft 9in
0
50
100
Scale MPH

Motor 5 - SLATER'S MICRODRIVE

E3-A. Drg 5 9/85

Manufactured by Slaters.

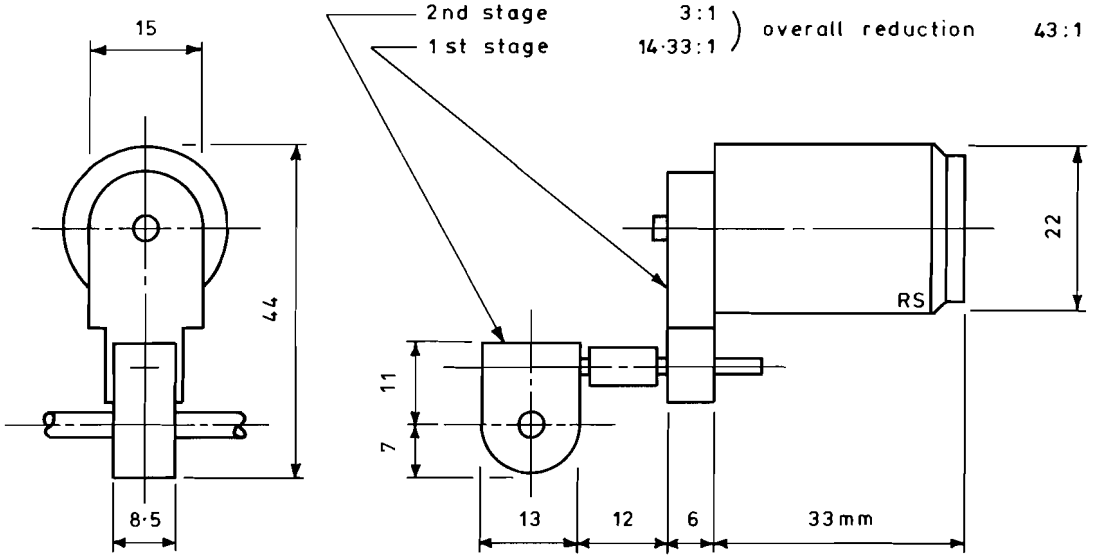
Motor details: Nominal voltage - 12 volts. No load speed - 8500 rpm. Maximum recommended current - 0.25 amps. Maximum recommended speed - 8000 rpm. Stalled torque - 168 gram cm.

Gearbox details: This consists of two separate sections. The first section spur gearbox has 14.3:1 reduction with an efficiency of 73%, and the second section skew gearbox has a 3:1 reduction with an efficiency of 75%. Overall reduction - 43:1. Overall efficiency - 55%. Driving axle speed - 198 rpm.

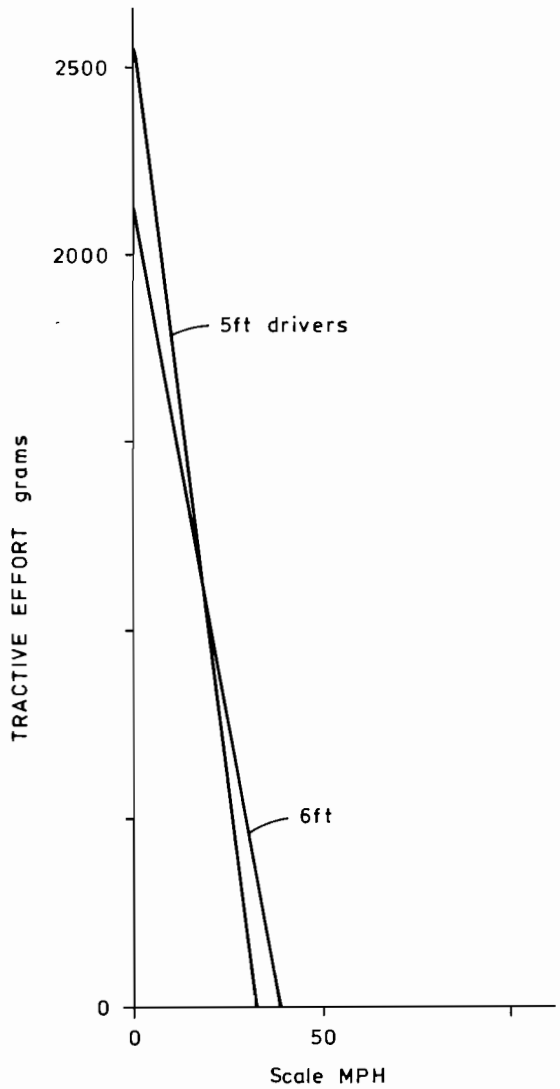
Comment: This combination gives a very high tractive effort but a low top speed. Suitable for heavy freight locomotives only.

Data source: Manufacturer's data sheet.

Available from Slaters, Temple Road, Matlock Bath, Derbyshire.



SEE REVERSE FOR GRAPH


2500
2000
5ft drivers
6ft
0
0
50
Scale MPH
TRACTIVE EFFORT grams

Motor 6 - SLATERS 7L002 (A-B-C)

Manufactured by Slaters.

Supplied fitted with a Faulhaber 2233-012S motor.

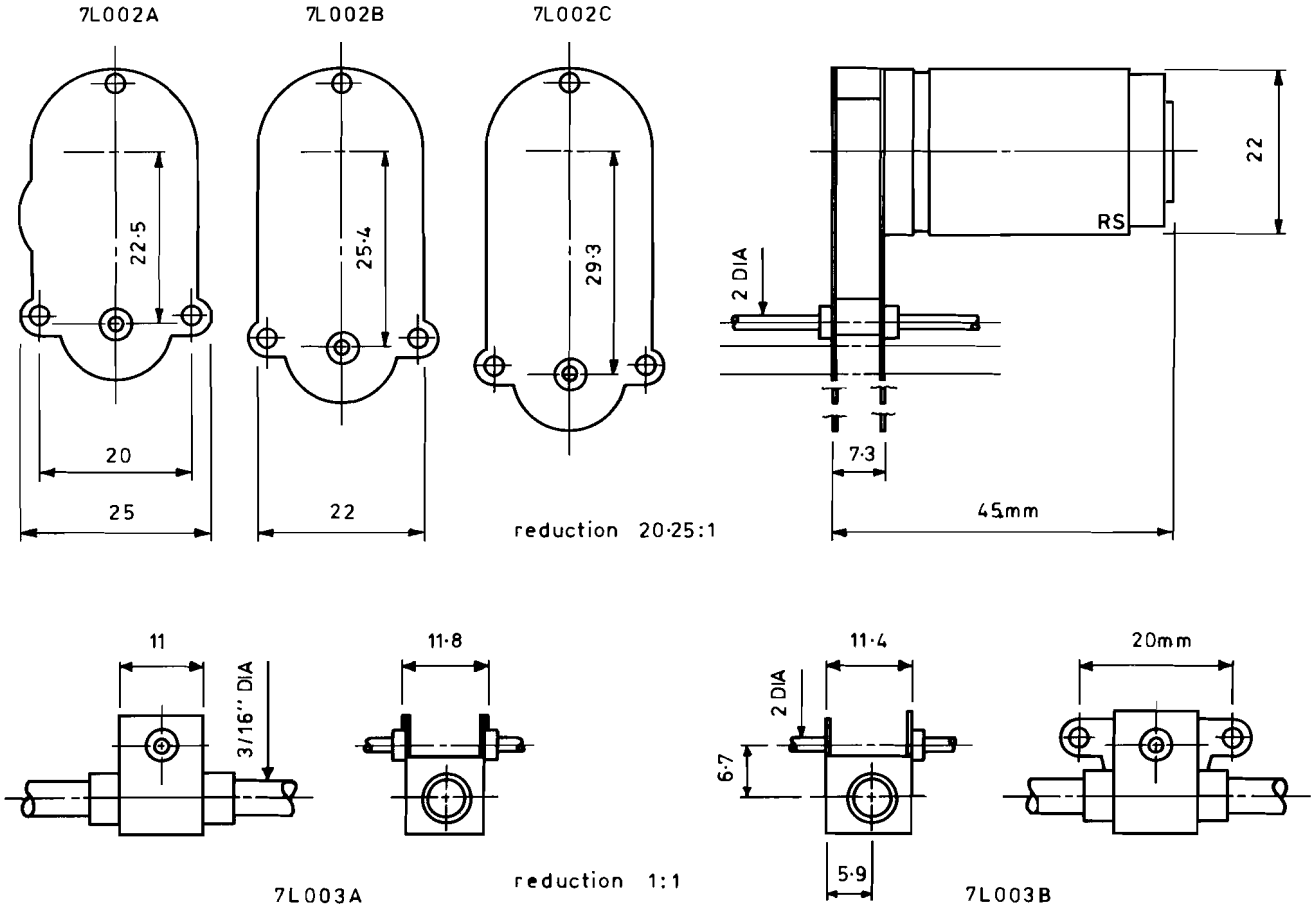
Motor details: Nominal voltage - 12 volts. No load speed - 8500 rpm. Maximum recommended current - 0.25 amps. Maximum recommended speed - 8000 rpm. Stalled torque - 168 gram cm.

Gearbox details: This consists of two separate sections. The first section spur gearbox has a reduction of 20.25:1 with an efficiency of 73%, and the second section is a 1:1 set of crossed helical gears with an efficiency of 75%. Overall reduction 20.25:1. Overall efficiency - 55%. Driving axle speed - 420 rpm.

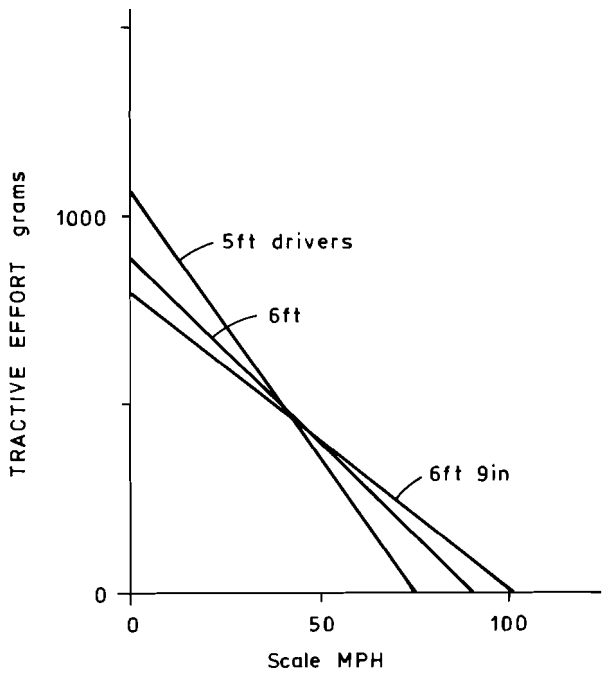
Comment: This combination gives a good tractive effort at all speeds. Suitable for most locomotive types.

Data Source: Manufacturer's data sheet.

Available from Slaters, Temple Road, Matlock Bath, Derbyshire.



SEE REVERSE FOR GRAPH


TRACTIVE EFFORT grams
1000
0
5ft drivers
6ft
6ft 9in
0
50
100
Scale MPH

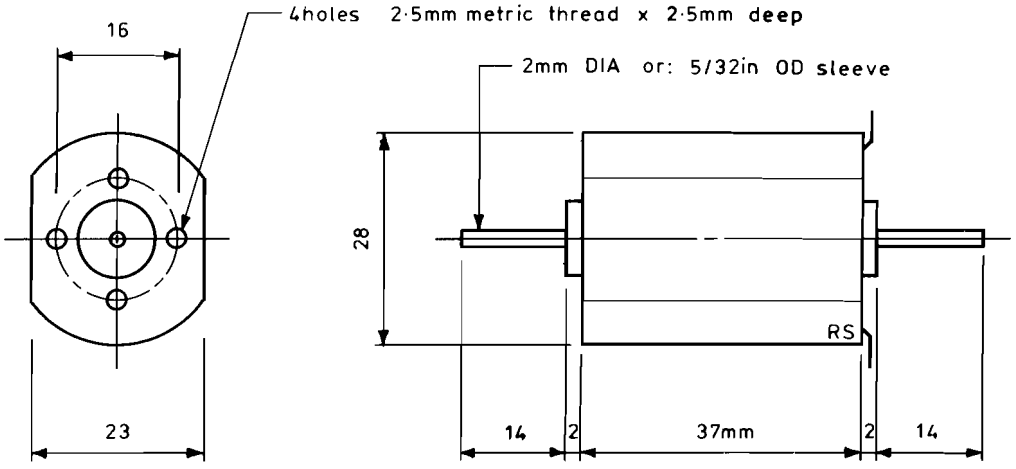
Motor 7A - JH MOTOR E3-A. DRG 7A 9/85

DC permanent magnet motor manufactured by Buhler.

3-pole armature - Carbon brushes.Self lubricating, self aligning bronze bearings. Nominal voltage - 12 volts. No load speed - 5720 rpm. Stalled current - 1.3 amps. Stalled torque - 200 gram cm.

Data source: Guild bench test.

Available from MSC Models Ltd, 1 Malvern Road, Hampton, Middlesex TW12 2LN, or their agents.



Motor 7b - MSC 25:1 GEARBOX for the JH MOTOR

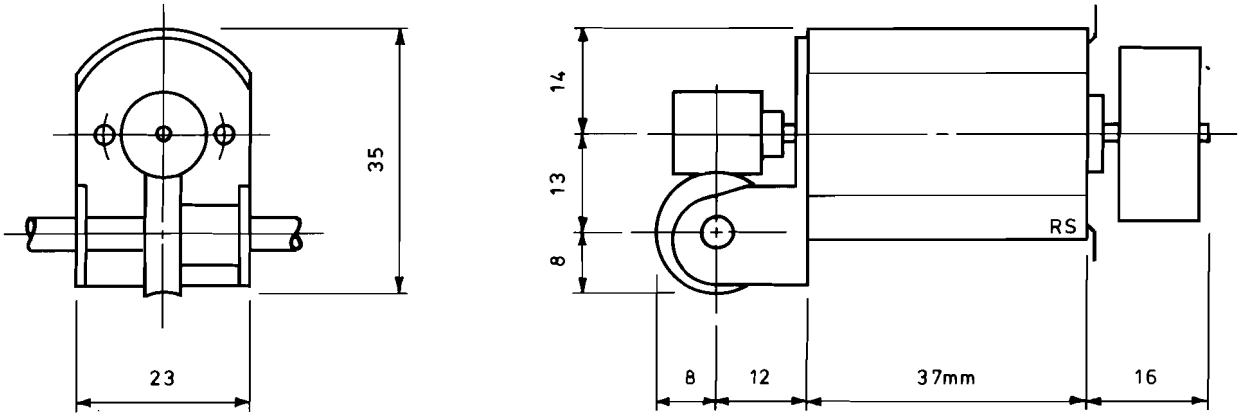
Motor details: Nominal voltage - 12 volts. No load speed - ~~5270~~ 5720 rpm. Stalled current - 1.3 amps. Stalled torque -200 gram cm.

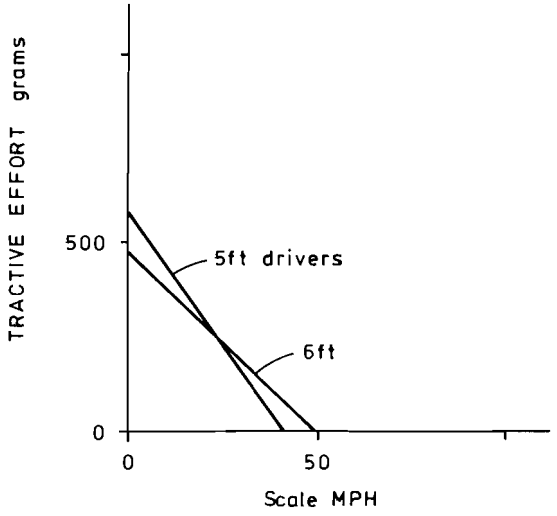
Gearbox: Efficiency - 20% (Worm end thrust taken by motor bearings). Driving axle speed - 229 rpm.

Comment: This combination gives adequate power but at low speed. Suitable for medium sized freight or mixed traffic locomotives.

Data source: Guild bench test.

Available from MSC Models Ltd, 1 Malvern Road, Hampton, Middlesex TW12 2LN.





June 1986

Motor 7c J H Motor - Serial Nos 1200 and above

D C permanent magnet motor manufactured by Buhler.

Motor Details

5-pole armature - Carbon brushes (replaceable).

Self lubricating, self aligning bronze bearings.

Nominal Voltage	12 volts
No load speed	11500 rpm
Stalled Current	3.27 amps
Stalled Torque	409 gram cm.

Data Source Guild Bench Test.

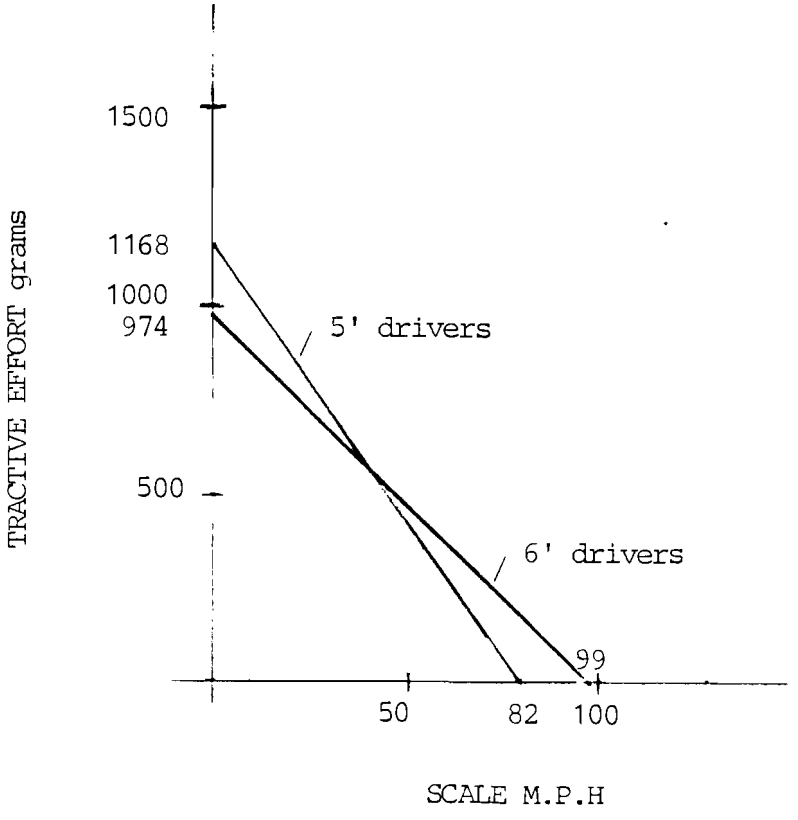
Available from MSC Models Limited
1 Malvern Road,
HAMPTON,
Middlesex,
TW12 2LN.

External appearance and dimensions as for Data Sheet 7a.

Motor 7d MSC 25:1 Gearbox for the JH 5-pole motor - Serial Nos 1200 and above

Motor Details	Nominal Voltage	12 volts.
	Stalled Current	3.27 amps.
	No load speed	11500 rpm.
	Stalled Torque	409 gram cm.
Gearbox:	Efficiency - 20% (Worm end thrust taken by motor bearing).	
	Driving axle speed	460 rpm.
Comment:	This combination has a good haulage capacity and speed range both for freight and express locomotives.	
Data Source:	Guild Bench Test	
Available from:	MSC Models Limited, 1 Malvern Road, HAMPTON, Middlesex TW12 2LN.	

External appearance and dimensions as for data sheet 7b.



Motor 8 - LEAKEY LL

E3-A. Drg 8 9/85

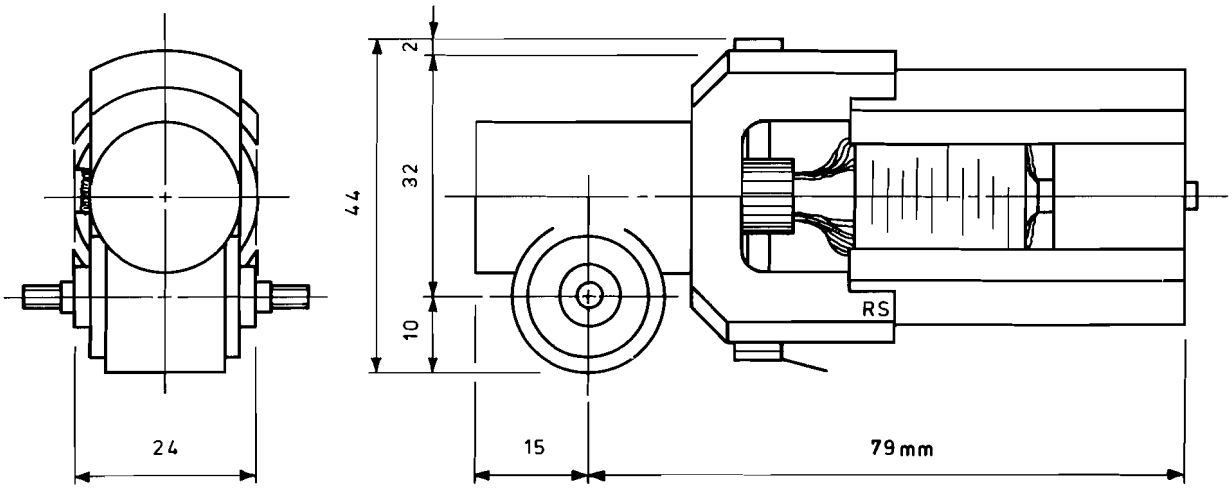
DC permanentmagnet motor/gearbox unit manufactured by DM Leakey.

3-pole armature, replaceable Carbon brushes. Motor and gearbox shafts carried in enclosed ball races. Nominal voltage - 12 volts. No load speed (motor) - 3700 rpm. Stalled current - 2.4 amps. Stalled torque - 750 gram cm. Gearbox ratio - 12:1. Efficiency - 50% (Worm end thrust taken by ball races). Driving axle speed - 308 rpm.

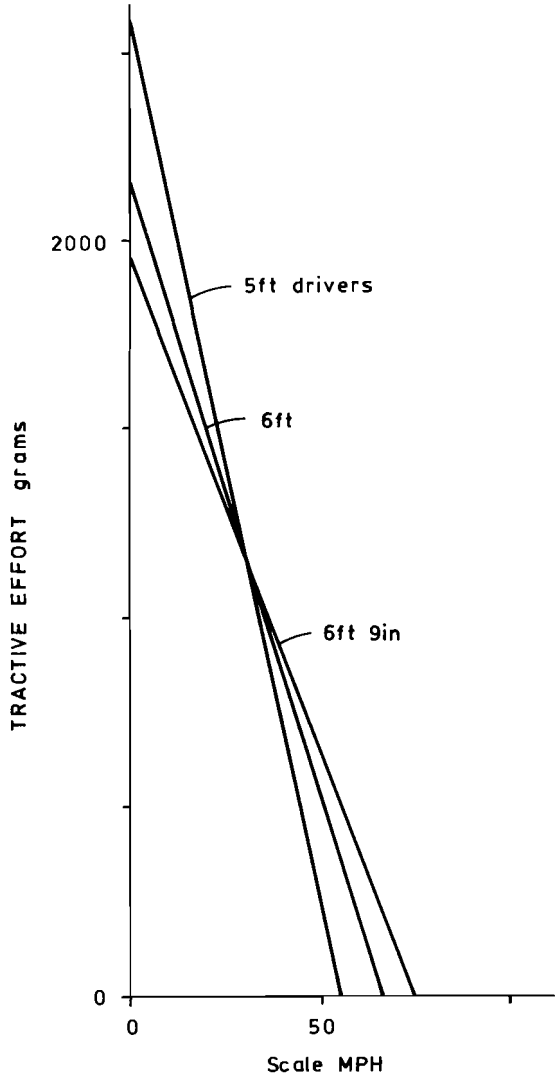
Comment : This unit has a very high tractive effort but is limited in its top speed. Suitable for the most powerful freight and mixed traffic locomotives.

Data source: Guild bench test.

Available from DM Leakey, 7 Camplin Street, New Cross, London SE14 8JX.



SEE REVERSE FOR GRAPH


2000
0
TRACTIVE EFFORT grams
5ft drivers
6ft
6ft 9in
0
50
Scale MPH

Motor 9 - LEAKEY IMP E3-A. Drg9 9/85

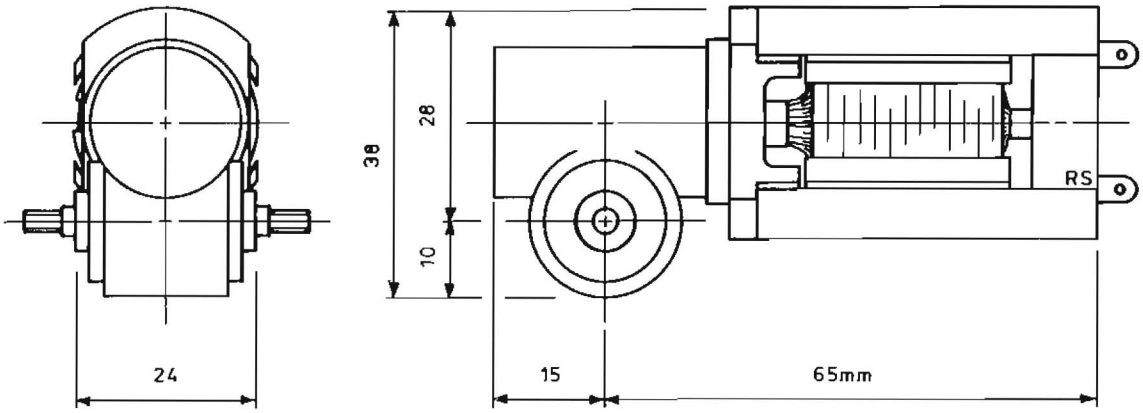
DC permanent magnet motor/gearbox unit manufactured by DM Leakey.

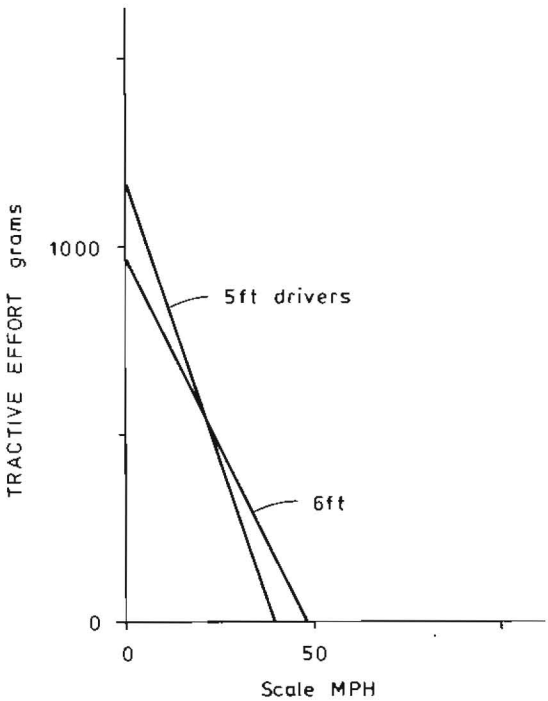
3-pole armature - replaceable Carbon brushes. Motor and gearbox shafts carried in enclosed ball races. Nominal voltage - 12 volts. No load speed (motor) - 5400 rpm. Stalled current - 1.7 amps. Stalled torque - 375 gram cm. Gearbox ratio - 24:1. Efficiency - 23% (Worm end thrust taken by ball races). Driving axle speed - 225 rpm.

Comment: This unit has a good tractive effort but is limited in its top speed. Suitable for most of the medium to large freight locomotives.

Data Source: Guild bench test.

Available from DM Leakey, 7 Camplin St, New Cross, London SE13 8JX.





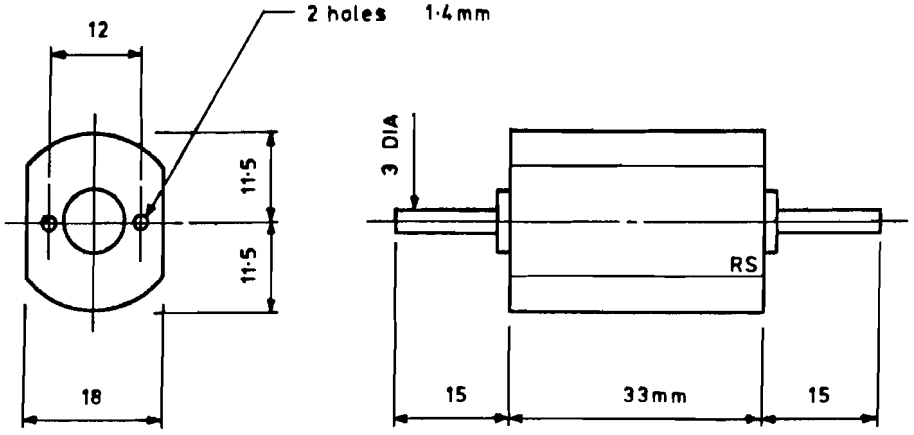
Motor 10 - ANCHORIDGE 1833

DC permanent magnet motor manufactured by Mashima, Japan.

5-pole armature - copper graphite replaceable brushes. Self aligning bearings. Nominal Voltage - 12 volts. No load speed - 9300 rpm. Stalled current - 1.56 amps. Stalled torque - 260 gram cm.

Data source: Guild bench test.

Available from MG Sharp Models, 712 Attercliffe Road, Sheffield S9 3RP.



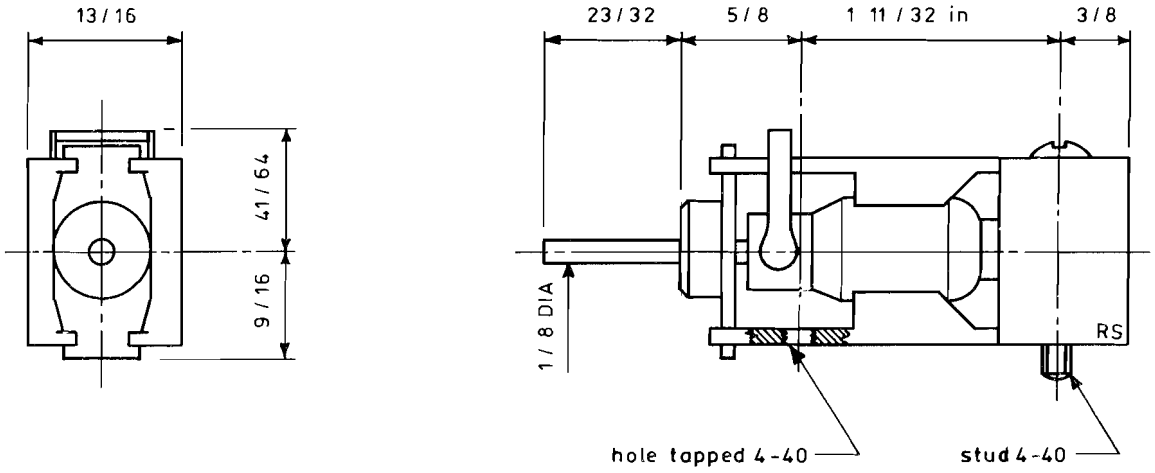
Motor 11 - PITTMAN DC 81 E3-A. Drg 11 9/85

DC permanent magnet motor manufactured by Pittman Corporation, USA.

5-pole armature - copper graphite replaceable brush tips. Self-aligning front bearing - flanged sleeve rear bearing. Lubrication - saturate front bearing oil wick with good grade light motor oil. Apply two or three drops direct to rear bearing. Nominal Voltage - 12 Volts. No load speed - 9500 rpm. Maximum current - 1.2 amps. Recommended speed - 7000 rpm. Current at recommended speed - 0.84 amps. Stalled torque - 213 gram cm.

Data source: Manufacturer's data sheets.

Available from CCW Model Manufacturing Ltd, Back Irvine Street, Leigh Road, Leigh, Lancs.



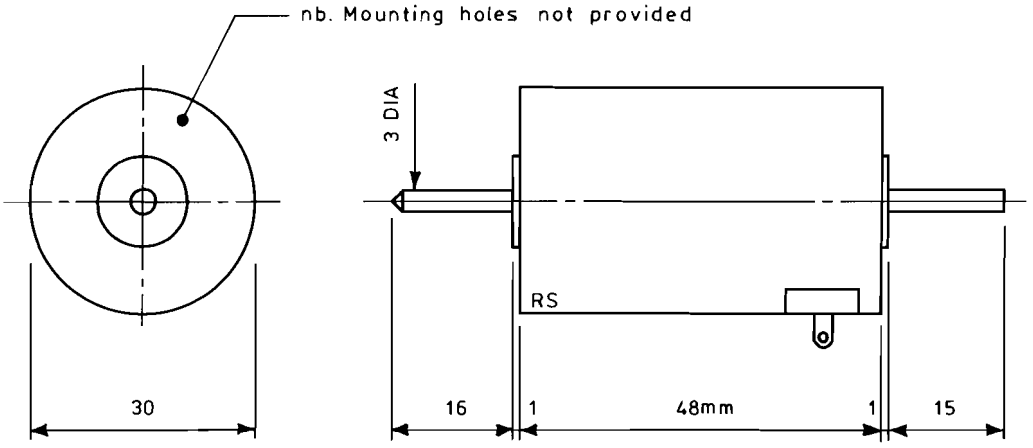
Motor 12 - PITTMAN 8212 B217

DC permanent magnet motor manufactured by Pittman Corporation, USA.

5-pole armature - Carbon brushes. Self lubricating self aligning bronze bearings. Nominal voltage - 12 volts. No load speed - 4200 rpm. Stalled current - 0.9 amps. Stalled torque - 275 gram cm.

Data source: Guild Bench test.

Available from Railway Workshop, Oulton Broad, Suffolk.



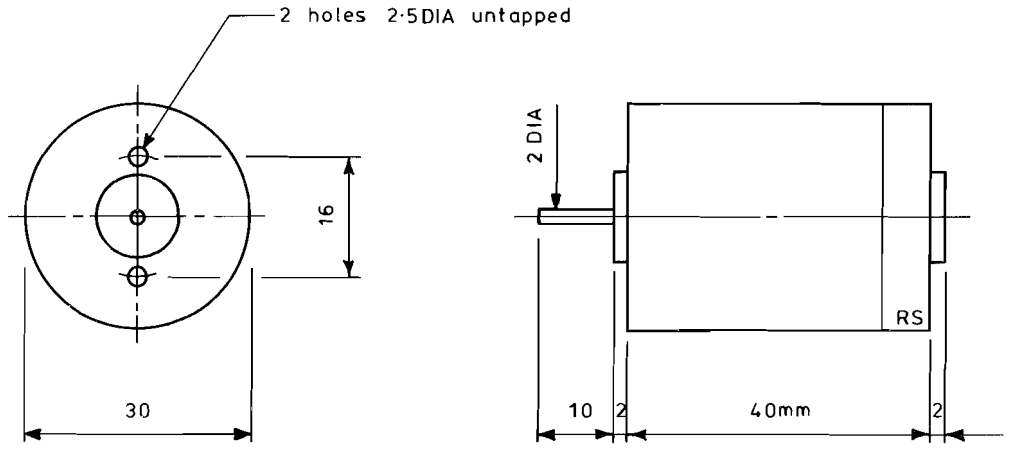
Motor 13 - RAVENSCALE S246

DC permanent magnet motor. Manufacturer and construction details not indicated.

Nominal voltage - 12 volts. No load speed - 8790 rpm. Stalled current - 2.6 amps. Stalled torque - 400 gram cm.

Data: Guild bench test.

Available from Ravenscale Model Manufacturing Co, 68 Eastwood Road, South Woodford, London E18.



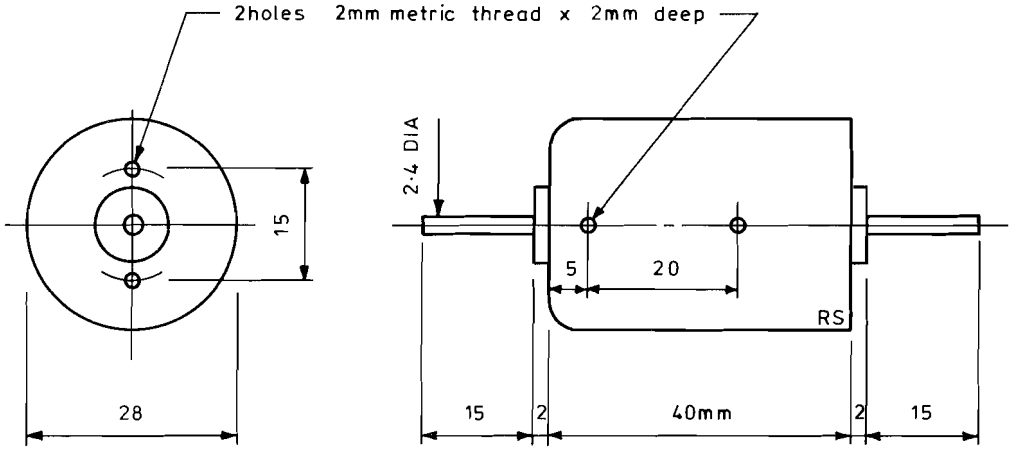
Motor 14a - SAGAMI 28401 E3-A. Drg 14a 9/85

DC permanent magnet motor manufactured by Sagami, Japan.

5-pole armature - Carbon brushes. Self-lubricating, self-aligning bronze bearings. Nominal voltage - 12 volts. No load speed - 8300 rpm. Recommended maximum continuous speed - 6300 rpm. Stalled current 2.1 amps. Stalled torque - 288 gram cm.

Data source: Manufacturer's data sheets.

Available from Cherry Scale Models, 25 Oakham Road, Whissendine, Oakham, Leics.



Motor 14b - CHERRY 12:1 and 24:1 GEARBOXES

Both boxes come fitted with a Sagami 28401 motor.

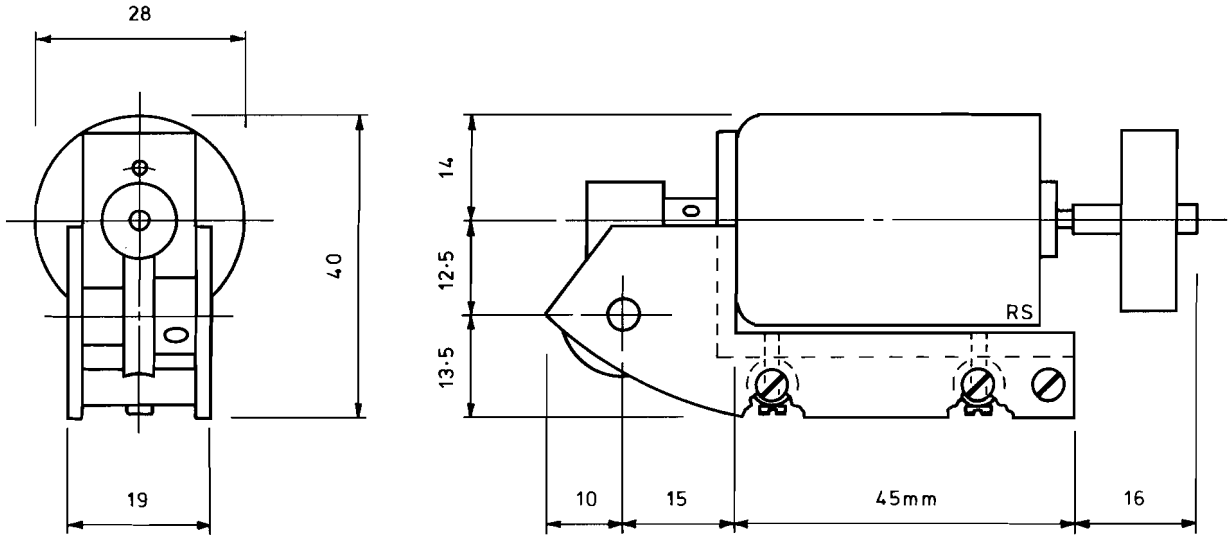
Motor details: Nominal voltage - 12 volts. No load speed - 8300 rpm. Stall current - 2.1 amps. Maximum continuous speed - 6300 rpm. Stalled torque - 288 gram cm.

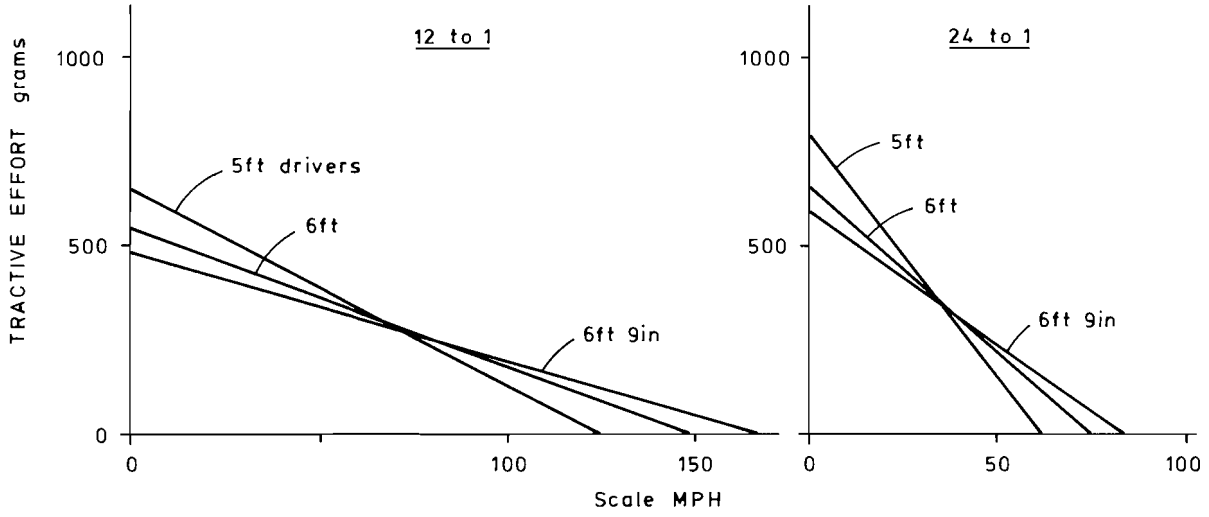
Gearbox details	12:1	24:1
Efficiency	33%	20%
Maximum recommended driving axle speed rpm	525	262.5

Comment: The 12:1 gearbox gives adequate haulage capacity and speed range for mixed traffic and express locomotives. The 24:1 gearbox gives a good tractive effort with a relatively low top speed suited to most of the medium to large freight locomotives.

Data source: Manufacturer's data sheets.

Available from Cherry Scale Models, 25 Oakham Road, Whissendine, Oakham, Leicester, LE15 7HA.





Motor 14c - CHERRY 18:1 and 36:1 GEARBOXES

Both boxes come fitted with a Sagami 2840l motor.

Motor details: Nominal voltage - 12 volts. No load speed - 8300 rpm. Stalled current - 2.1 amps. Maximum continuous speed - 6300 rpm. Stalled torque - 288 gram cm.

Gearbox details:	18:1	36:1
Efficiency	30%	18%
Maximum recommended driving axle speed rpm	350	175

Comment: The 18:1 gearbox has a good haulage capacity and speed range for both freight and express locomotives. The 36:1 gearbox has a low top speed but a high tractive effort suitable for the most powerful freight locomotives.

Data source: Manufacturer's data sheets.

Available from Cherry Scale Models, 25 Oakham Road, Whissendine, Oakham, Leicester, LE15 7HA.