

QC2000 Modular Crane Packages

Spacemaster 2000
Hoists & Components

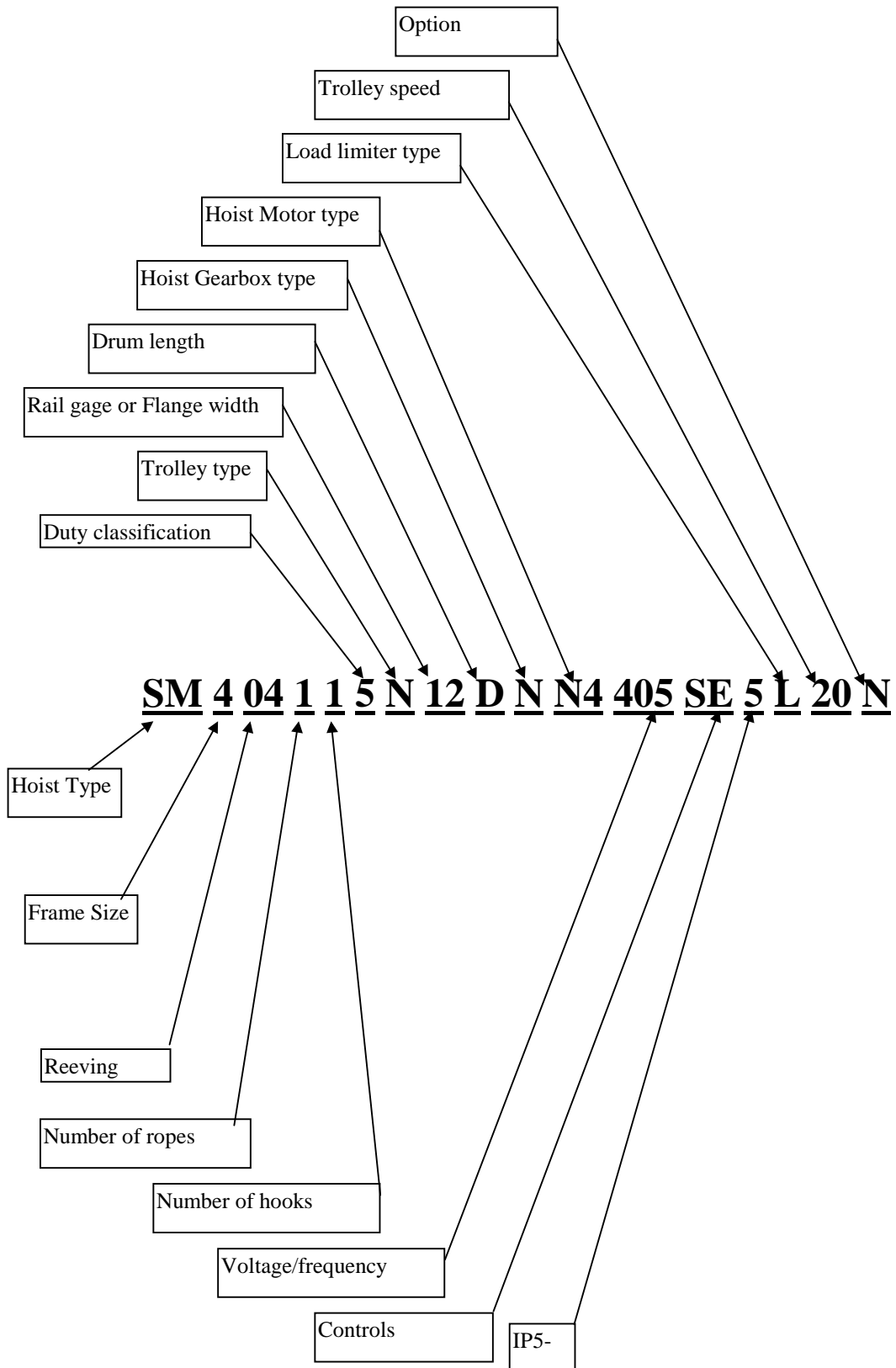
TECHNICAL
GUIDE



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SM HOIST CODE	1
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DUTY CLASSIFICATION	2
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According to FEM classification, two fundamental criteria must be taken into account:

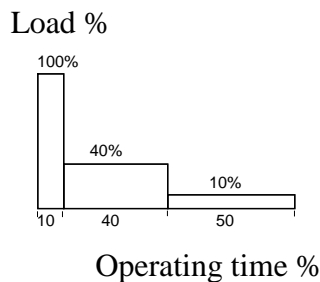
- Type of duty (load spectrum)(k)
- Average daily operated time (Tm)

I) Type of Duty (load spectrum)

I.a) Approximate determination

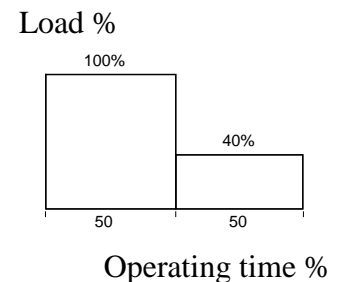
LIGHT

(k < or = 0.5)
Occasional full load.
Usually light load.
Small fixed load.



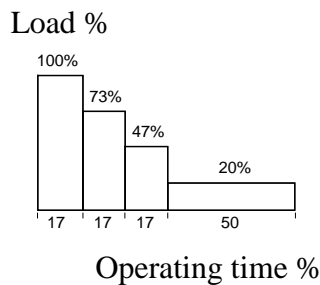
HEAVY

(0.63 < k < or = 0.8)
Repetitive full load.
Usually average load.
Heavy fixed load.



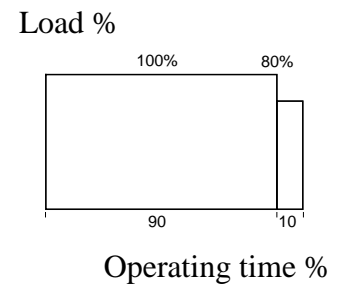
MEDIUM

(0.5 < k < or = 0.63)
Occasional full load.
Usually light load.
Average fixed load.



VERY HEAVY

(0.8 < k < or = 1)
Usually almost full load.
Very heavy fixed load.



I.b) Strict determination

For an exact classification into groups the cubic mean value k referred to the load to be lifted is required. It is calculated using the following formula:

$$k = \sqrt[3]{\left(\left(\frac{C1}{Cm} \right)^3 \cdot \left(\frac{T1}{Tm} \right) + \left(\frac{C2}{Cm} \right)^3 \cdot \left(\frac{T2}{Tm} \right) + \left(\frac{C3}{Cm} \right)^3 \cdot \left(\frac{T3}{Tm} \right) + \dots \right)}$$

Since the life of the mechanism is inversely proportional to the cube of the load.

Symbols:

- C1, C2, C3, ... useful or partial load
- T1, T2, T3, ... daily operating time under useful or partial load
- Tm = T1+T2+T3+... average daily operating time

DUTY CLASSIFICATION	2
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II) Daily Operating Time (T_m)

T_m is the total daily operating time with load and without load

III) Determination of the FEM Classification

Class of duty (load spectrum)		Average daily operating time in hours					
service	k	< 0.5 h	< 1 h	< 2 h	< 4 h	< 8 h	< 16 h
light	k < 0.5	-	1 Cm	1 Bm	1 Am	2m	3m
medium	0.5 < k < 0.63	1 Cm	1 Bm	1 Am	2m	3m	4m
heavy	0.63 < k < 0.8	1 Bm	1 Am	2m	3m	4m	5m
very heavy	0.8 < k < 1	1 Am	2m	3m	4m	5m	-

IV) FEM Classification Checking

It is necessary to check the duty factor and the number of starts per hour.

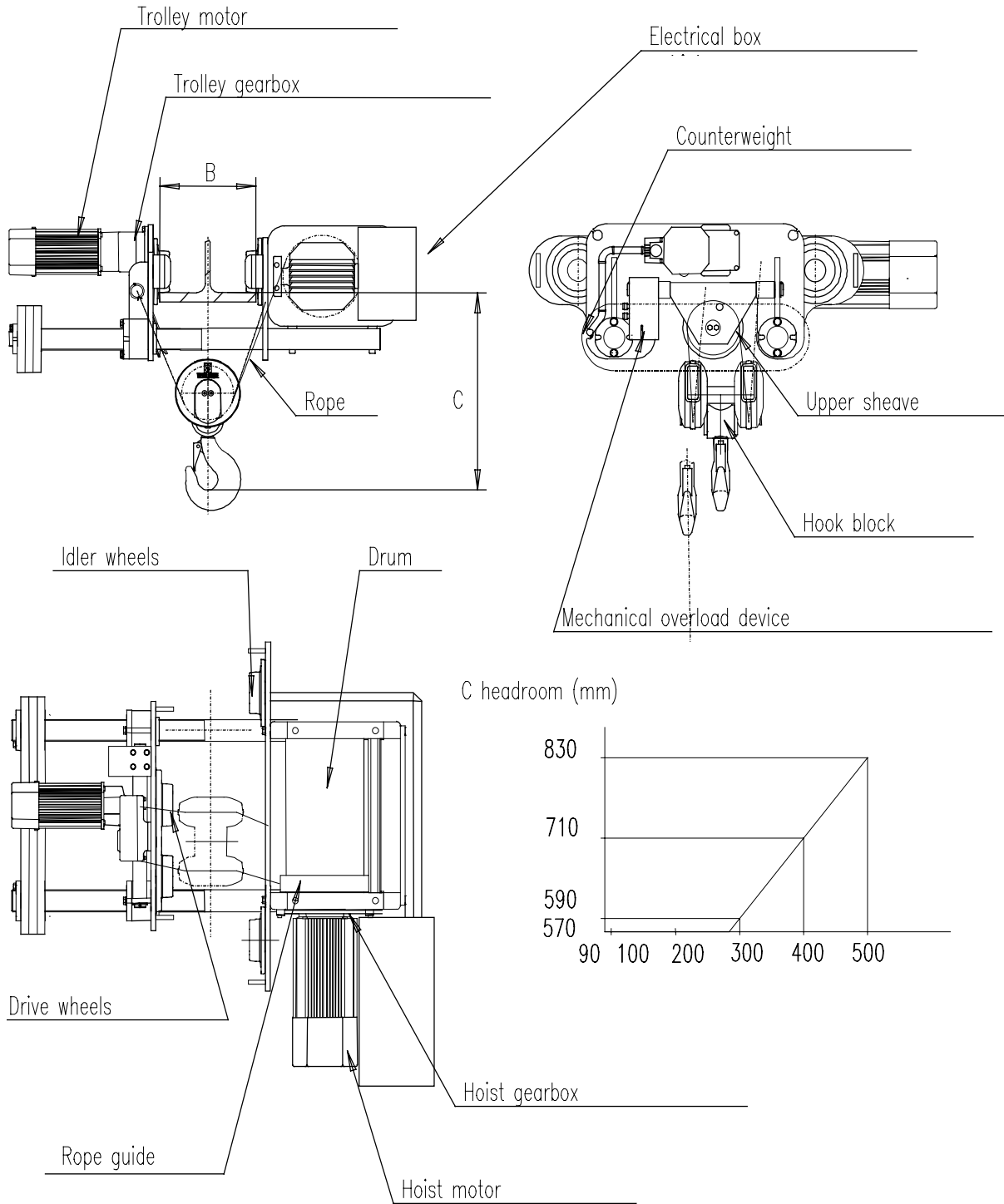
$$\text{Duty factor} = \frac{\text{(lifting time + lowering time)}}{\text{(lifting time + idle time + lowering time + idle time)}}$$

GROUP	1 Bm	1 Am	2m	3m	4m
Duty factor	25%	30%	40%	50%	60%
Number of starts per hour	150	180	240	300	360
Life of mechanisms under full load 250 hours/year					
	400	800	1600	3200	6400

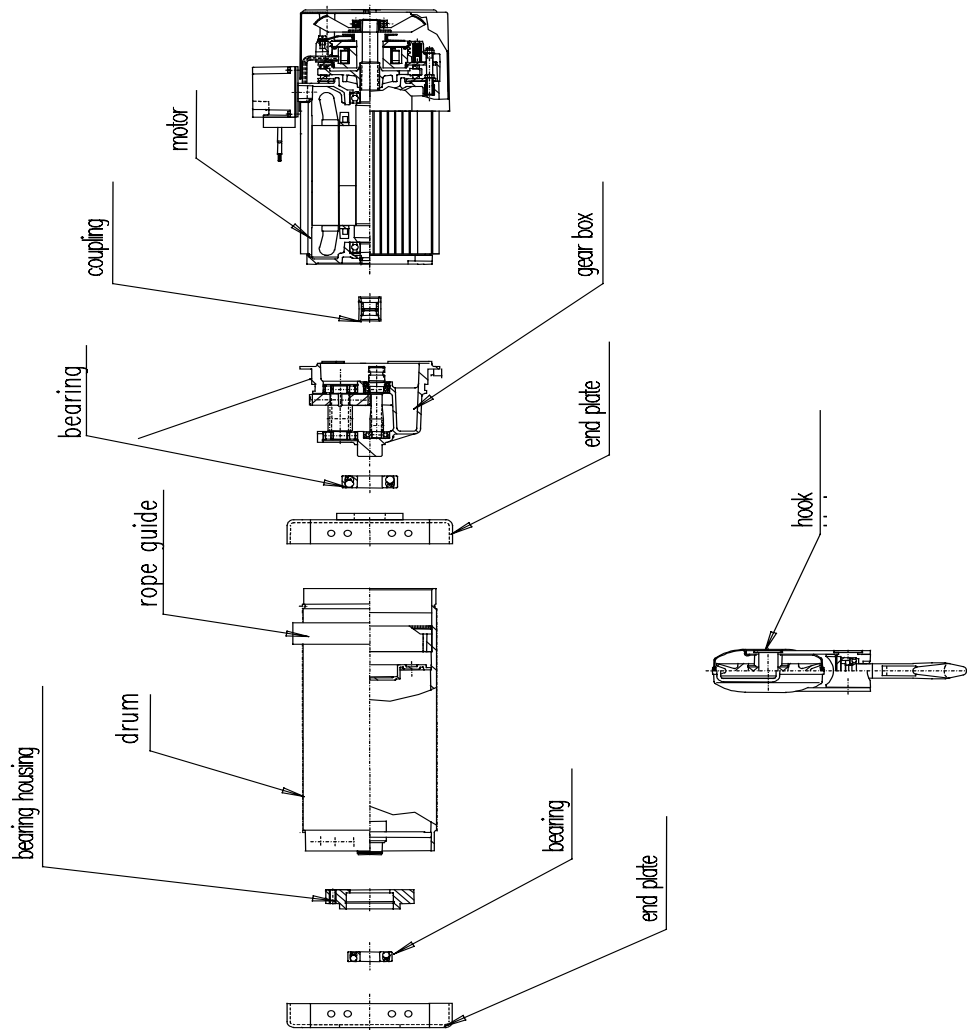
V) FEM / ISO / ASME

Group FEM	1Bm	1Am	2m	3m	4m
Group ISO	M3	M4	M5	M6	M7
Group ASME	H2	H3	H4	H5	H5

DESCRIPTION	3
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DESCRIPTION	3
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MAIN SPECIFICATIONS	4
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Single Reeve

STANDARD REEVING	SM1	SM2	SM3	SM3	SM4	SM4	SM4
Rope diameter (mm)	6	7	9	9	13	13	13
Drum pitch diameter (mm)	152	244	244	244	318	318	318
Hoisting gear	N	N	L	R	L	R	N
Motor / drum ratio	72	115	144	72	187	94	120
Hoist Motor Code	N1	N2	N2	N3	N3	N4	N4
Load 4/1 (Kg) 1Am	2000	3200	5000	5000	10000	10000	10000
Load 4/1 (U.S. Ton)	2	3	5	5	10	10	10
High Speed 4/1 (m/min)*	5	5	4	8	4	8	6,3
High Speed 4/1 (m/min)**	6	6	4.8	9.6	4.8	9.6	7.6
High Speed 4/1 (ft/min)**	19.7	19.7	15.8	31.5	15.8	31.5	25

True Vertical Lift

TRUE VERTICAL LIFT	SM4 TVL	SM4 TVL	SM4 TVL
Rope diameter (mm)	9	9	9
Drum pitch diameter (mm)	318	318	318
Hoisting gear code letter	L	R	N
Motor / drum ratio	187	94	120
Hoisting motor	N3	N4	N4
Load 12/2 (Kg) 1Am	16000	16000	16000
Load 12/2 (US ton) 1Am	15	15	15
High Speed 12/2 (m/min)*	2.7	5.3	4.2
High Speed 12/2 (m/min)**	3.2	6.4	5.1
High Speed 12/2 (ft/min)**	10.5	21	16.7
Load 16/2 (Kg) 1Am	20000	20000	20000
Load 16/2 (US ton) 1Am	20	20	20
High Speed 16/2 (m/min)*	-	4	-
High Speed 16/2 (m/min)**	-	4.8	-
High Speed 16/2 (ft/min)**	-	15.8	-

Capacities and Speeds are listed in both metric and U.S. customary units.

* 50 Hertz Motor

**60 Hertz Motor

HOIST MOTORS

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1) MOTORS

- Squirrel-cage motors
- Double winding for two speed motor
- Synchronous speed : 3000 / 500 rpm for 50 hertz
- Synchronous speed : 3600 / 600 rpm for 60 hertz
- Power range from 1.9 to 15 kW for 50 hertz
- Power range from 2.2 to 18 kW (2.9 to 24 HP) for 60 hertz
- IP55 protection
- Insulation Class F
- Tropicalized as an option
- Thermistors for over-temperature protection
- Aluminum frame
- N1...N4 are standard two speed hoisting motors.
- F2...F4 are standard inverter hoisting motors.

1.1.1 Ambient temperature

The design of the motors is based on a maximum ambient temperature of 40° C (104° F).

If ambient temperature exceeds 40° C (104° F), a motor from a higher classification must be selected:

For ambient temperatures in the range 40° C -55° C (104° F -131° F), the motor must be selected from one step higher in the Motor Group classification.

For ambient temperatures in the range 55° C-65° C (131° F -149° F), the motor must be selected from two step higher in the Motor Group classification.

Environmental Factors

The standard SM2000 Hoist Motor is designed for operation at a maximum ambient temperature of 40 °C (104 °F) at a maximum altitude of 1000 m (3280 ft.). If these environmental conditions are exceeded, make sure that the motor has been specified for this special application.

The hoist must be installed in such a position that the cooling air can circulate freely over the motor.

The heated air must not recirculate back immediately to the cooling fan inlet.

1.1.2 N -motors

These motors (N1, N2, N3, and N4) are standard 2-speed hoist motors.

1.1.3 F -motors

These motors (F2, F3, and F4) are specially designed for use with a variable frequency drive and all of these motors only have a single winding.

The variable frequency drive utilizes a general-purpose inverter that can modify both the frequency and the voltage of the supply waveform to the motor. The speed of the motor can be then be controlled over its full range in a stepless manner.

These motors are equipped with a pulse sensor for speed feedback to the variable frequency drive. The electric brake is also controlled by the variable frequency drive.

HOIST MOTORS

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1.2 Motor winding temperature protection

As standard, on all SM2000 hoist motors, thermistors (electrothermal sensors) for over-temperature protection are embedded in the stator windings. The sensors have a low resistance until their temperature rises to a set point, whereupon resistance increases several orders of magnitude for a relatively small change in temperature. This sharp increase in resistance causes a thermal relay to de-energize a pilot circuit. Each phase winding has its own thermistor so that there are three thermistors in a single speed motor and six thermistors in a 2-speed motor. The thermistors are connected in series within the motor.

1.3 Motor cooling

All motors have a ribbed outer casing to maximize convection cooling.

1.3.1 Hoist motor sizes MF09 - MF13

SM2000 hoist motors in the size range MF09 - MF13 are normally fitted with an integral cooling fan that is directly driven by the motor shaft.

Because the shaft driven fan is only effective while the hoist motor is rotating, this cooling may not be sufficient for certain applications, especially where the ambient temperature is high. In these cases, a blower fan replaces the shaft driven fan.

1.4 Mechanical brake

SM2000 hoist motor is fitted with a disc brake to hold the shaft stationary when the motor is not energized. This electric brake is integrated into the design of the motor and is located between the motor casing and the cooling fan. A single disc is used, with friction linings on both sides.

The hub of the disc is engaged onto a toothed spline on the motor shaft so that it always rotates with the motor. The disc can move axially along the shaft to accommodate any wear in the friction linings. The brake is engaged by a number of coil springs that force a stationary pressure plate against the disc. There is also a fixed backing plate between the other side of the disc and the motor casing. To release the brake, the solenoid coil is energized. The attraction force from the solenoid is greater than the force of the springs and so the brake is released. Because the brake always engages when the solenoid is not energized, the system is fail-safe.

1.4.1 Characteristics of the brake

The brake type depends on the motor type and on the nominal voltage of the motor.

Motor code	Brake type	Braking torque
N1	NM304NR_*	10.8 Nm
N2	NM305NR_*	21.6 Nm
N3,F3	NM306NR_*	44 Nm
N4,F4	NM307NR_*	87 Nm

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*Depending on the nominal voltage of the motor, the voltage code of the brake is as follows:

Nominal voltage of the motor	Voltage code of the brake	Nominal voltage of brake
346V - 480V	NR1	190 V
500V - 600V	NR2	220 V
660V - 690V	NR3	290 V
200V - 240V	NR4	100 V

Brake adjustment

The electric brake is released by a solenoid that overcomes the forces of the brake engagement springs. For this solenoid to operate correctly, the air gap between the coil body and the armature plate must be within certain limits. If the air gap is too small, the brake will not release completely. If the air gap is too large, the solenoid force will not be strong enough to attract the armature and the brake will remain fully engaged.

As the friction linings on the brake disc wear, the air gap increases. To compensate for this effect, the air gap must be adjusted.

1.4.2 Automatic brake adjustment (MF09 - MF13 Standard)

For the brakes fitted to the motors in this size range, the solenoid coil is directly attached to the brake pressure plate. The armature ring is at the outer end of the brake assembly and this ring does not move when the solenoid is energized.

This armature ring with a threaded outer circumference engages matching thread in the brake body. By turning the armature ring, the air gap is set.

As standard, the brakes for the motors in this size range are fitted with an automatic adjustment mechanism. This consists of a multi-turn spring between the armature ring and the brake body. This spring acts to turn the armature ring in the direction that reduces the air gap.

The air gap is prevented from reducing to zero by a neoprene O-ring. The solenoid force can compress O-ring, but it can not be compress by the automatic adjustment mechanism.

1.4.3 Manual brake adjustment (MF09 - MF13 Special)

In certain operating environments, especially where there is a large amount of airborne dust or smoke particles, the automatic adjustment mechanism can become clogged by the dirt and can stop functioning.

If no remedial action is taken, the solenoid will eventually stop releasing correctly, leaving the brake partially engaged. As a result of partial engagement, the wear rate of brake will increase significantly. Ultimately, the brake can fail if the friction linings are worn away completely.

To avoid this potentially dangerous situation, the automatic adjustment mechanism is not fitted to hoist motors that will be used in such hostile environments. Instead, the solenoid ring is prevented from rotating inside the brake body by an adjustable bracket.

The brake must be inspected and adjusted manually as part of a routine maintenance procedure.

1.5 "Lining Worn" sensing (MF09 - MF13)

A "Lining Worn" sensing circuit is fitted to all of the brake sizes that can have the automatic adjustment mechanism. This sensing circuit consists of a loop of insulated wire that is embedded within the friction lining of the brake.

When the lining is worn, the brake disc open the sensing loop. This sensing circuit is wired into the motor control logic to ensure that the hoist cannot be operated in an unsafe condition.

For the smaller motor sizes (MF09, MF10, MF11), the wear-sensing loop is only in one friction lining. For other MF13 motors, the sensing loop is in both friction linings (wired in series).

HOIST MOTORS

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2) Main characteristics

Two-speed Hoist Motor at 50 Hertz

MOTOR CODE		N1	N2	N3	N4
Motor type		MF09ZA106	MF10Z-106	MF11Z-106	MF13ZA106
synchronous speed	rpm	3000/500	3000/500	3000/500	3000/500
Braking torque	Nm	10.8	21.6	44	87
Power fact. start		0.89/0.80	0.82/0.79	0.75/0.68	0.65/0.61
Starting torque	Nm	12/10.7	26/22	48/42	105/86
Weight	Kg	23	30	50	87
Load	tm/min	8	20	40	80
Nominal power *	kW	1.5/0.25	3.5/0.5	7.5/1.2	15/2.5
Nominal torque	Nm	4.7	12.7	24.7	48
Nominal speed	r/min	2750/400	2780/400	2750/360	2810/430
Short time duty	min	15/15	15/11	15/10	15/10
Power factor		0.83/0.63	0.87/0.63	0.85/0.55	0.86/0.49
Efficiency		0.67/0.25	0.71/0.28	0.74/0.30	0.78/0.44

*) Power are given with nominal load

Two-speed Hoist Motor at 60 Hertz

Motor code		N1	N2	N3	N4
Motor type		MF09ZA106	MF10Z-106	MF11Z-106	MF13ZA106
Synchronized speed	RPM	3600/600	3600/600	3600/600	3600/600
Braking torque	Nm	10.8	21.6	44	87
Power fact. start		0.88/0.78	0.80/0.77	0.73/0.67	0.64/0.56
Starting torque	Nm	11.6/10.3	26/22	48/42	102/82
Weight	kg	23	30	50	87
Inertia	kgm ²	0.0041	0.0047	0.0090	0.0393
Load	tm/min	12/2.0	23/3.0	49/8.0	95/16
Nominal power*	HP	3/0.5	5.6/0.83	12/2	24/4
Nominal power*	kW	2.2/0.37	4.2/0.6	9/1.5	18/3
Nominal torque	Nm	6.3	12.7	24.7	48
Nominal speed	RPM	3260/475	3380/500	3350/450	3400/520
Short time duty	min	15/15	15/11	15/10	15/10
Power factor		0.91/0.61	0.87/0.61	0.87/0.55	0.90/0.48
Efficiency		0.67/0.31	0.75/0.31	0.73/0.33	0.79/0.48

*) Powers are given with nominal load.

HOIST MOTORS

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2) Main characteristics

Inverter Hoist Motor at 50 Hertz

MOTOR CODE	F3	F4
Motor type	MF11L-100	MF13L-100
Synchronous speed rpm	3000	3000
Braking torque Nm	44	87
Power factor - start	1.0/1.0	1.0/1.0
Starting torque Nm	78	120
Weight Kg	46	78
Load tm/min	40	80
Nominal power * kW	7.5	15
Nominal torque Nm	24.7	48
Nominal speed r/min	2860	2860
Power factor	0.90	0.93
Efficiency	0.83	0.84

*) Power with nominal load

Inverter Hoist Motor at 60 Hertz

MOTOR CODE	F3	F4
Motor type	MF11L-100	MF13L-100
Synchronous speed rpm	3600	3600
Braking torque Nm	44	87
Power factor - start	1.0/1.0	1.0/1.0
Starting torque Nm	78	120
Weight Kg	46	78
Load tm/min	48	96
Nominal power HP	12	24
Nominal power * kW	9	18
Nominal torque Nm	24.7	48
Nominal speed r/min	3460	3460
Power factor	0.90	0.93
Efficiency	0.85	0.86

*) Powers are given with nominal load.

HOIST MOTORS

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3) Currents (Motors 50 Hz)

Motor type	Currents * (fast/slow speed)	Duty Group	Voltage					
			220 V	380 V	400 V	415 V	500 V	660 V
N1 MF09ZA106	Starting current (A)		29/5.5	17/3.2	16/3.0	15/2.9	13/2.4	9.7/1.8
	Nominal current (A)	1Am	6.4/4.0	3.7/2.3	3.5/2.2	3.4/2.2	2.8/1.8	2.1/1.3
		2m	5.8/4.0	3.4/2.3	3.2/2.2	3.1/2.2	2.6/1.8	1.9/1.3
		3m	5.3/4.0	3.1/2.3	2.9/2.2	2.8/2.2	2.3/1.8	1.8/1.3
N2 MF10Z-106	Starting current (A)		70/12	41/6.8	39/6.5	38/6.3	31/5.2	24/3.9
	Nominal current (A)	1Am	15.0/7.8	8.5/4.5	8.1/4.3	7.8/4.1	6.5/3.4	4.9/2.6
		2m	13.0/7.8	7.6/4.5	7.2/4.3	6.9/4.1	5.8/3.4	4.4/2.6
		3m	11.0/7.8	6.4/4.5	6.1/4.3	5.9/4.1	4.9/3.4	3.7/2.6
N3 MF11Z-106	Starting current (A)		133/22	77/13	73/12	70/12	58/9.6	44/7.3
	Nominal current (A)	1Am	30.0/14.0	17.0/8.2	16.5/7.8	16.0/7.5	13.0/6.2	10.0/4.7
		2m	26.0/14.0	15.0/8.2	14.0/7.8	14.0/7.5	11.0/6.2	8.5/4.7
		3m	22.0/14.0	13.0/8.2	12.0/7.8	12.0/7.5	9.6/6.2	7.3/4.7
N4 MF13ZA106	Starting current (A)		291/51	168/29	160/28	154/27	128/22	97/17
	Nominal current (A)	1Am	56.0/27.0	33.0/16.0	31.0/15.0	30.0/15.0	25.0/12.0	19.0/9.1
		2m	47.0/27.0	27.0/16.0	26.0/15.0	25.0/15.0	21.0/12.0	16.0/9.1
		3m	40.0/27.0	23.0/16.0	22.0/15.0	21.0/15.0	18.0/12.0	13.0/9.1

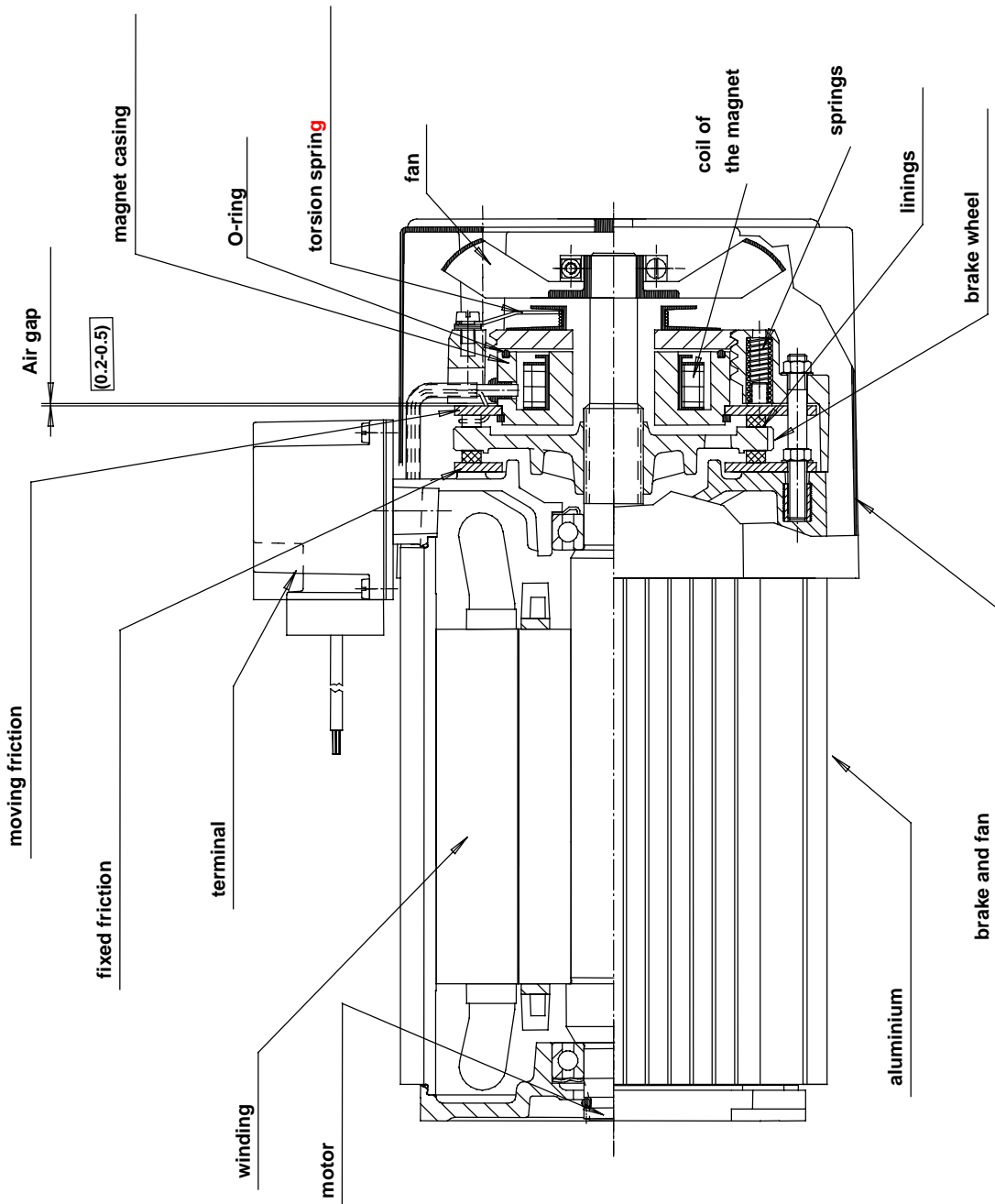
3) Currents (Motors 60 Hz)

Motor type	Currents (fast/slow speed)	Duty Group	Voltage					
			220 V	380 V	440 V	460 V	480 V	600 V
N1 MF09ZA106	Starting current (A)		33/6.3	19/3.6	17/3.1	16/3	15/2.9	13/2.4
	Nominal current (A)	1Am	7.3/4.6	4.2/2.7	3.7/2.3	3.5/2.2	3.4/2.1	2.8/1.8
		2m	6.7/4.6	3.9/2.7	3.3/2.3	3.2/2.2	3.1/2.1	2.6/1.8
		3m	5.0/4.6	2.9/2.7	2.5/2.3	2.4/2.2	2.3/2.1	2.3/1.8
N2 MF10Z-106	Starting current (A)		82/14	47/7.9	41/6.8	39/6.5	37/6.2	31/5.2
	Nominal current (A)	1Am	17/9.0	10/5.2	8.6/4.5	8.2/4.3	7.9/4.1	6.6/3.4
		2m	15/9.0	8.7/5.2	7.5/4.5	7.2/4.3	6.9/4.1	5.8/3.4
		3m	13/9.0	7.4/5.2	6.4/4.5	6.1/4.3	5.8/4.1	4.9/3.4
N3 MF11Z-106	Starting current (A)		138/25	80/15	69/13	66/12	63/12	58/9.6
	Nominal current (A)	1Am	36/16	21/9.4	18/8.2	17/7.8	16/7.5	13/6.2
		2m	29/16	17/9.4	15/8.2	14/7.8	13/7.5	11/6.2
		3m	25/16	15/9.4	13/8.2	12/7.8	12/7.5	9.6/6.2
N4 MF13ZA106	Starting current (A)		335/59	194/34	167/29	160/28	153/27	128/22
	Nominal current (A)	1Am	65.0/31.0	38.0/18.0	32.0/16.0	31.0/15.0	30/14	25/12
		2m	54.0/31.0	31.0/18.0	27.0/16.0	26.0/15.0	25/14	21/12
		3m	46.0/31.0	27.0/18.0	23.0/16.0	22.0/15.0	21/14	18/12

*) Current with nominal load

HOIST MOTORS	5
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4) Hoisting motor description



HOIST GEARS

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Hoist types SM1, SM2, SM3 are fitted with 3-step helicoidal reduction gear units, lubricated by semi-liquid grease. The reduction gear is not sealed, and the drum acts as the casing. A pinion, engaging on a geared wheel that is integral with the drum, rotates the drum.

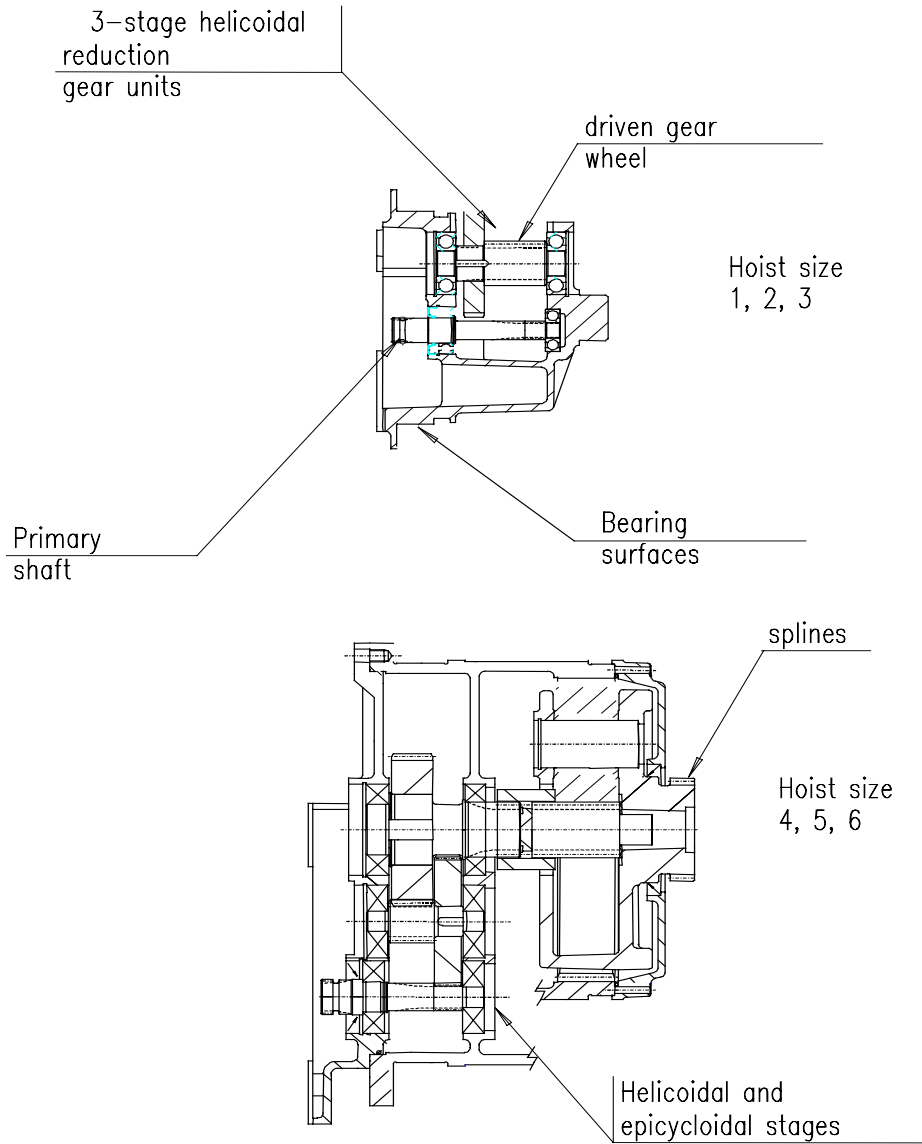
Hoist type SM4 is fitted with 2-stage reduction gears, the first stage being helicoidal and the second epicyclical. This is an oil bath assembly, and the gearbox is sealed. The drum is actuated by a tapered shaft co-axial to the drum, actuating an end plate that is one piece (welded) with the drum.

HOIST	GEAR	NAME	Reference Number	MOTOR	RATIO Motor / drum	LUBRICANT FOR GEAR	QUANTITY
SM1	N	1G1100	1117502	N1	72	MOBIL SHC007	235 grams ½ lbs.
SM2	N	3G2300	1127502	N2	115	MOBIL SHC007	235 grams ½ lbs.
SM3	L	3G2200	1137502	N2	144	MOBIL SHC007	235 grams ½ lbs.
	N	3G3500	1137504	N3	92		
	R	3G3300	1137503	N3	72		
SM4	L	4G3300	1147502	N3	187	MOBIL GEAR 630	1.4 liter or 1.5 quarts except LHT Hoists 2 liter or 2.1 quarts
	N	4G4600	1147504	N4	120		
	R	4G4400	1147503	N4	94		

LHT = Low Headroom Trolley

HOIST GEARS

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DRUMS	7
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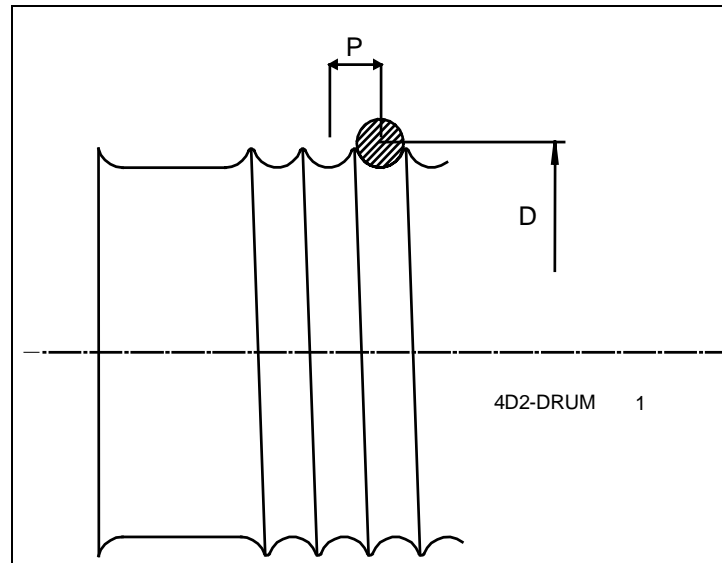
The rope drum is fitted with a rope guide. The purpose of the rope guide is to help guide and keep the rope in the drum grooves. The grooves are machined smooth and groove edges are rounded. Clamps with bolts fasten the rope end to the drum. Drum lengths are noted in the SM hoist code by a letter as shown below.

Drum length code

Code letter	A	B	C	D	E	G
Length (mm)	510	620	720	900	1400	2000

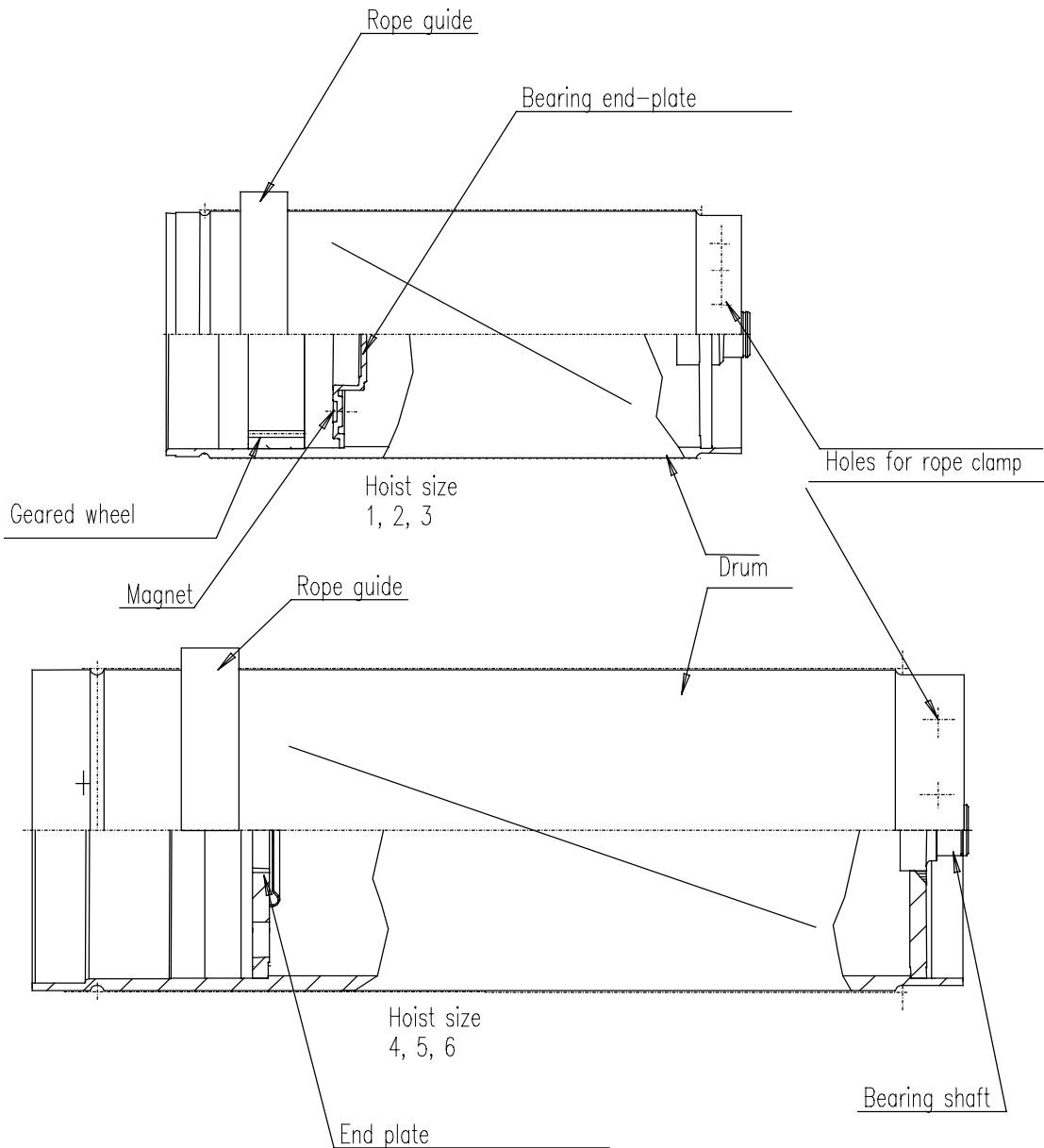
Drum dimensions

HOIST	reeving	Drum pitch ϕ , D (mm)	Length Code	ROPE ϕ d (mm)	Pitch length, P (mm)	D/d ratio	Clamps quantity
SM1	4/1	152	A	6	6.3	25.33	2
SM2	4/1	244	A,C	7	7.8	34.85	2
SM3	4/1	244	A,C	9	9.9	27.1	3
SM4	4/1	318	B, D	13	14.3	24.5	5
	12/2	318	E	9	9.9	35.3	2
	16/2	318	G	9	9.9	35.3	2

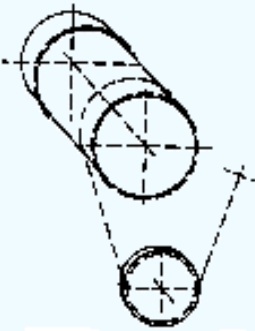


DRUMS

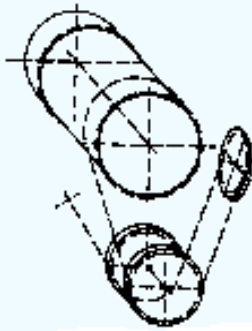
7



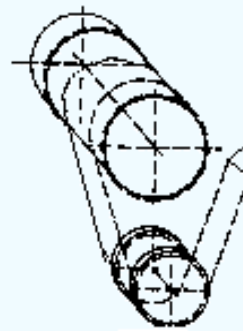
REEVING	8
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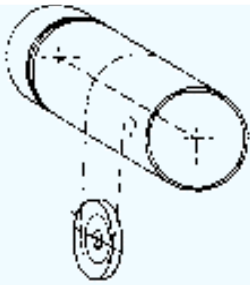
2/1 STD (SM1-SM5)



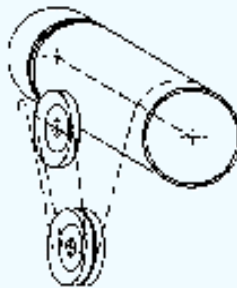
4/1 STD (SM1-SM5)



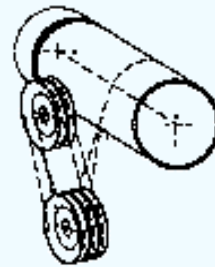
4/2 STD LV (SM1-



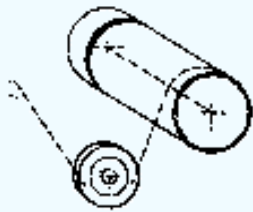
2/1 (SM6)



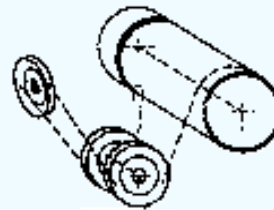
4/1 (SM6)



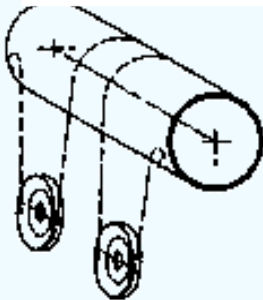
6/1 (SM3-SM5)



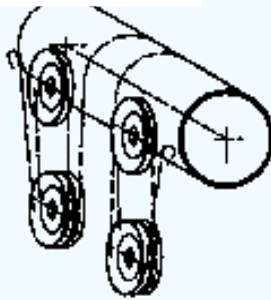
2/1 LHT / HPR (SM1-SM4)



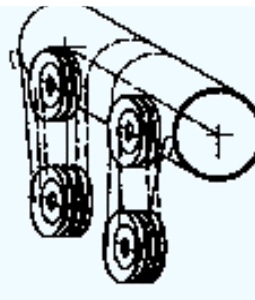
4/1 LHT / HPR (SM1-SM4)



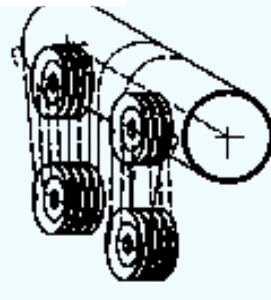
4/2 LV
(SM5-SM6)



8/2 LV
(SM5-SM6)



12/2 LV
(SM4-SM6)



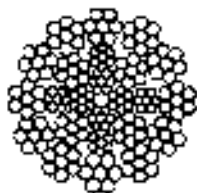
16/2 LV
(SM4-SM6)

HOISTING ROPE	9
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I) ROPE TYPES USED



17 x 7 AGM



NRHD 24 x 7
NRHD 24 x 17



6 x 21 FC dyform
6 x 31 FC dyform



8 x 25 F - CWP

Note! The used rope types are subject to change. If the rope information is critical, always check the existing rope type case by case.

The actual rope diameter is between the tolerance of the nominal diameter as follow:

Nominal diameter	Tolerance %	
(mm)	Rope with strands exclusively of wire	Rope with fiber strand cores
6 <...< 7	+5 -1	+7 -1
> 8	+4 -1	+6 -1

II) ROPES CALCULATED BY FEM AND ASME HST – 4M

FEM recommendations:

Hoist FEM duty group	1Bm	1Am	2m	3m	4m
Min. design safety factor	3.55	4	4.5	5.6	7.1

ASME HST – 4M recommendations:

Hoist ASME duty group	H1 – H5
Min. design safety factor	5

HOISTING ROPE	9
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III) ROPE TYPE

Hoist	Drum	Rope ϕ mm	Rope construction	Strength of wire N/mm ²	Min. breaking load kg
SM104114	A	6	AGM 17x7	2160	2966
SM204114	A, C	7	AGM 17x7	2160	4118
SM304114	A,C	9	Compact 9x17	2160	7289
SM404114	B,D	13	Compact 9x17	2160	15495
SM412214	E	9	Compact 9x17	2160	7289
SM416214	G	9	Compact 9x17	2160	7289

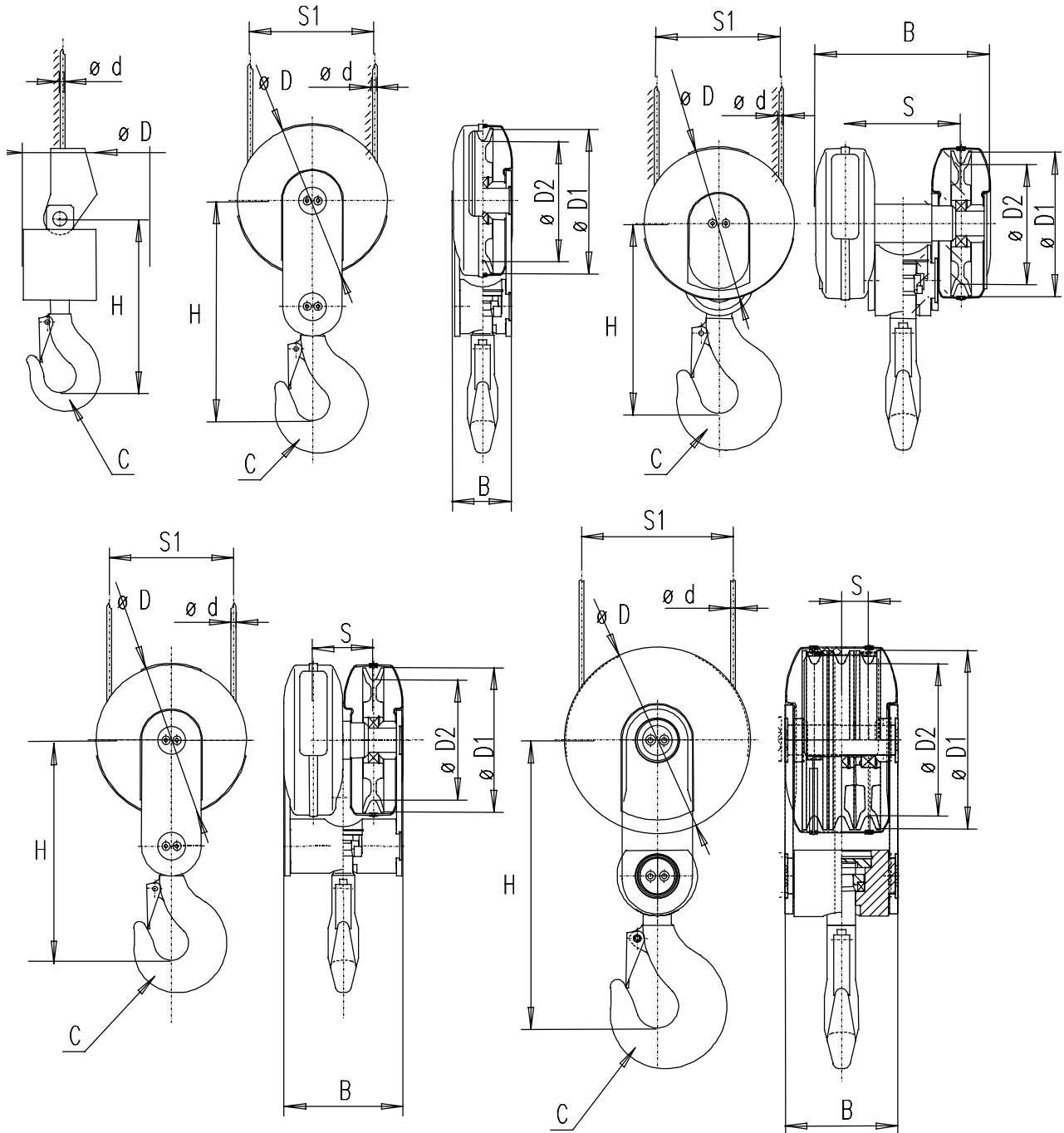
Caution regarding hoist ropes:

A damaged rope may cause other components such as the rope guide and/or sheaves to become damaged. A damaged sheave or rope guide may damage or even break the new replacement wire rope. The wire rope and all related items shall be checked and replaced as necessary for excessive wear or damage.

HOOK BLOCK

10

I) HOOK BLOCK DIMENSIONS – 4/1

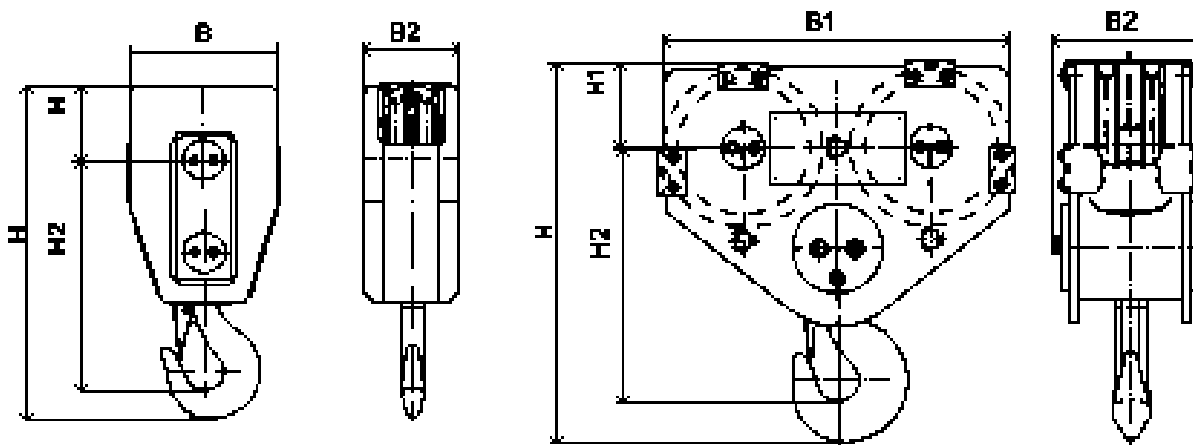


HOOK BLOCK	10
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I) HOOK BLOCK DIMENSIONS – 4/1

Hoist	FEM	Hook size	ød	H	S	S1	B	D	D1	D2
			mm	mm	mm	mm	mm	mm	mm	mm
SM10411-	1Am,2m,3m	RSN1	6	245	156	125	246	164	148	119
SM20411-	1Am,2m,3m	RSN2.5	7	290	179	156	265	204	188	149
SM304114	1Am	RSN2.5	9	290	175	162	265	204	188	153
SM30411-	2m,3m	RSN4	9	350	214	231	323	282	265	222
SM404114	1Am	RSN4	13	350	214	235	323	282	265	221
SM40411-	2m,3m	RSN5	13	400	259	293	392	347	330	280

II) HOOK BLOCK DIMENSIONS – TRUE VERTICAL LIFT

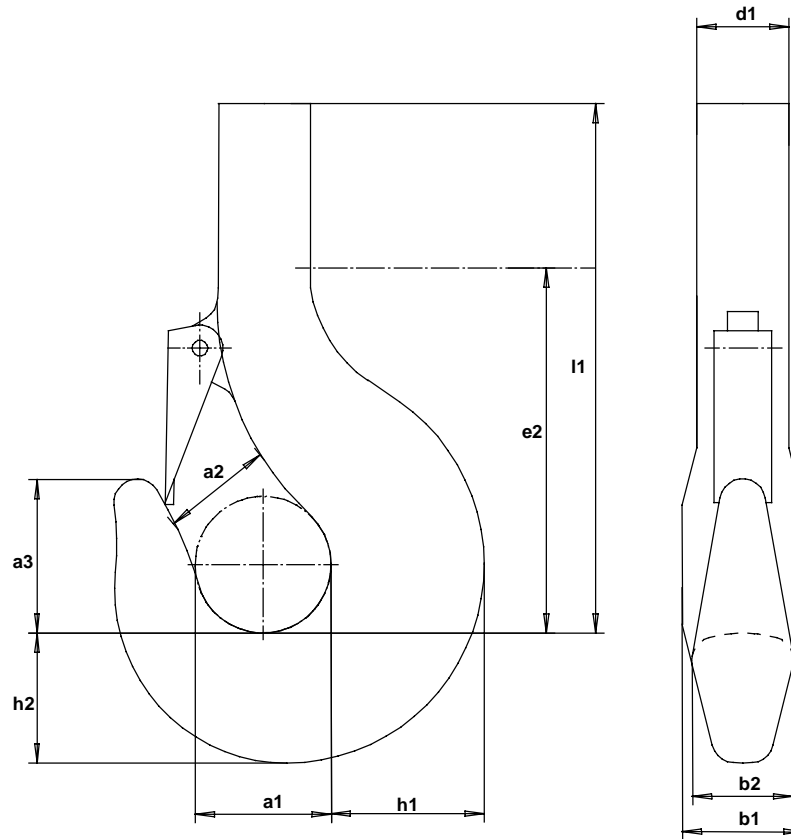


Hoist	FEM Duty	Hook size	ød	H	H1	H2	B1	B2	CC
			mm	mm	mm	mm	mm	mm	mm
SM41221	1Am	RSN4	9	755	143	525	596	248	292
SM41621	1Am		9	755	143	525	596	248	292

HOOK BLOCK

10

III) HOOK DIMENSIONS



	RSN1	RSN2.5	RSN4	RSN5	RSN6	RSN10	RFN10	RFN16	RFN20	RSN25
a1	50	63	71	80	90	112	112	140	160	180
a2	40	50	56	63	71	90	90	112	125	140
a2' *	35	41	44	48	56	75	75	97	110	125
a3	57	72	80	90	101	127	127	160	180	202
b1	38	53	63	71	80	100	100	125	140	160
b2	32	45	53	60	67	85	85	106	118	132
d1	30	42	48	53	60	75	75	95	106	118
e2	128	167	190	215	240	286	286	357	405	455
h1	48	67	80	90	100	125	125	160	180	200
h2	40	58	67	75	85	106	106	132	150	170
l1	197	253	285	318	374	452	460	595	665	724
Weight	3.2 kg	6.3 kg	8.8 kg	12.3 kg	17.1 kg	40 kg	40.0 kg	77.0 kg	112 kg	160 kg

* a2 dimension with safety catch. Dimensions are mm.

SHEAVES	11
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- Groove 45°
- Life-time lubricated bearing
- Groove hardness is 220 BHN

Hoist	FEM classification	Sheave Pitch ϕ (mm) Hook block	Sheave Pitch ϕ (mm) Sheave frame	Groove radius mm	Wire rope ϕ mm
SM1041	1Am, 2m , 3m	126	126	3.7	6
SM2041	1Am	156.5	126	3.7	7
SM2041	2m , 3m	156.5	156.5	3.7	7
SM3041	1Am	162	162	4.8	9
SM3041	2m , 3m	231	231	4.8	9
SM4041	1Am	234	234	7	13
SM4041	2m , 3m	293	293	7	13
SM4122	1Am	231	231	4.8	9
SM4162	1Am	231	231	4.8	9

LOAD LIMITER

12

On hoist types of SM1, SM2, and SM3, the load limiter is made up of Belleville washers arranged in a box unit that is mounted to a structure. The fixed point or the jack shaft pulley exerts a force downwards, from which a slight displacement downwards results for the jack shaft subassembly. This movement actuates a limit switch in the event of an overload.

Washer assembly SM1 to SM3

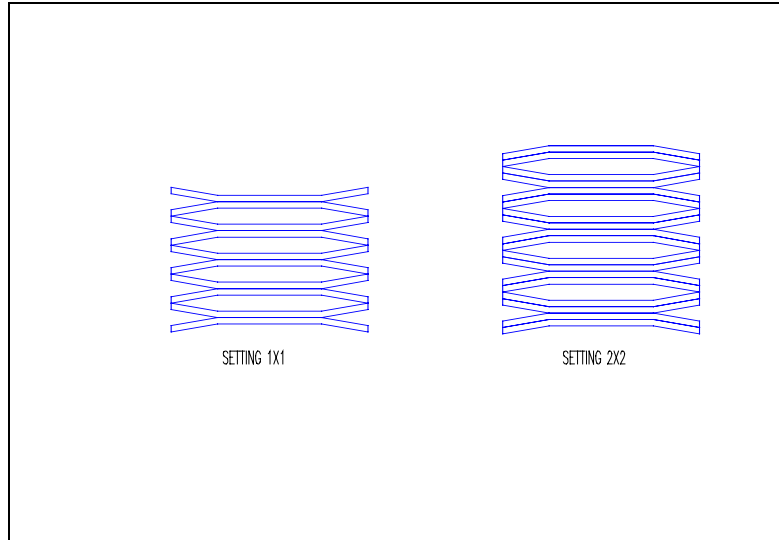
Hoist	Load (kg)	Load (US Ton)	Spring washer	Number	Assembly Arrangement
SM104...R	1250	---	D	10	1x1
SM104...R	1600	---	D	8	1x1
SM104...R	2000	---	C	8	1x1
SM104...F&N	1250	---	F	16	2x2
SM104...F&N	1600	---	D	10	1x1
SM104...F&N	2000	---	C	8	1x1
SM104...R	----	1.0	E	12	1x1
SM104...F&N	----	1.0	D	10	1x1
SM104...F&N	----	1.5	D	10	1x1
SM104...F&N	----	2.0	C	10	1x1
SM204...R	2500	---	B	9	1x1
SM204...R	3200	---	A	9	1x1
SM204...R	4000	---	A	9	1x1
SM204...F&N	2500	---	B	9	1x1
SM204...F&N	3200	---	A	9	1x1
SM204...F&N	4000	---	C	12	2x2
SM204...R,F&N	----	2.5	B	9	1x1
SM204...R,F&N	----	3.0	A	9	1x1
SM204...R,F&N	----	4.0	C	12	2x2
SM304...F&N	3200	---	A	9	1x1
SM304...F&N	4000	---	A	9	1x1
SM304...F&N	5000	---	C	12	2x2
SM304...R	6300	---	C	12	2x2
SM304...F&N	6300	---	A	10	2x2
SM304...R, F&N	----	3.0	A	9	1x1
SM304...R, F&N	----	4.0	C	12	2x2
SM304...R, F&N	----	5.0	C	12	2x2
SM304...R	----	6.0	B	10	2x2
SM304...F&N	----	6.0	A	10	2x2

R = Low Headroom Trolley, F = Foot Mount, N = Standard Headroom Trolley. For double girder trolley, use F suspension arrangement.

LOAD LIMITER

12

Belleville Washer Arrangement SM1 to SM3:



Spring Assembly SM4

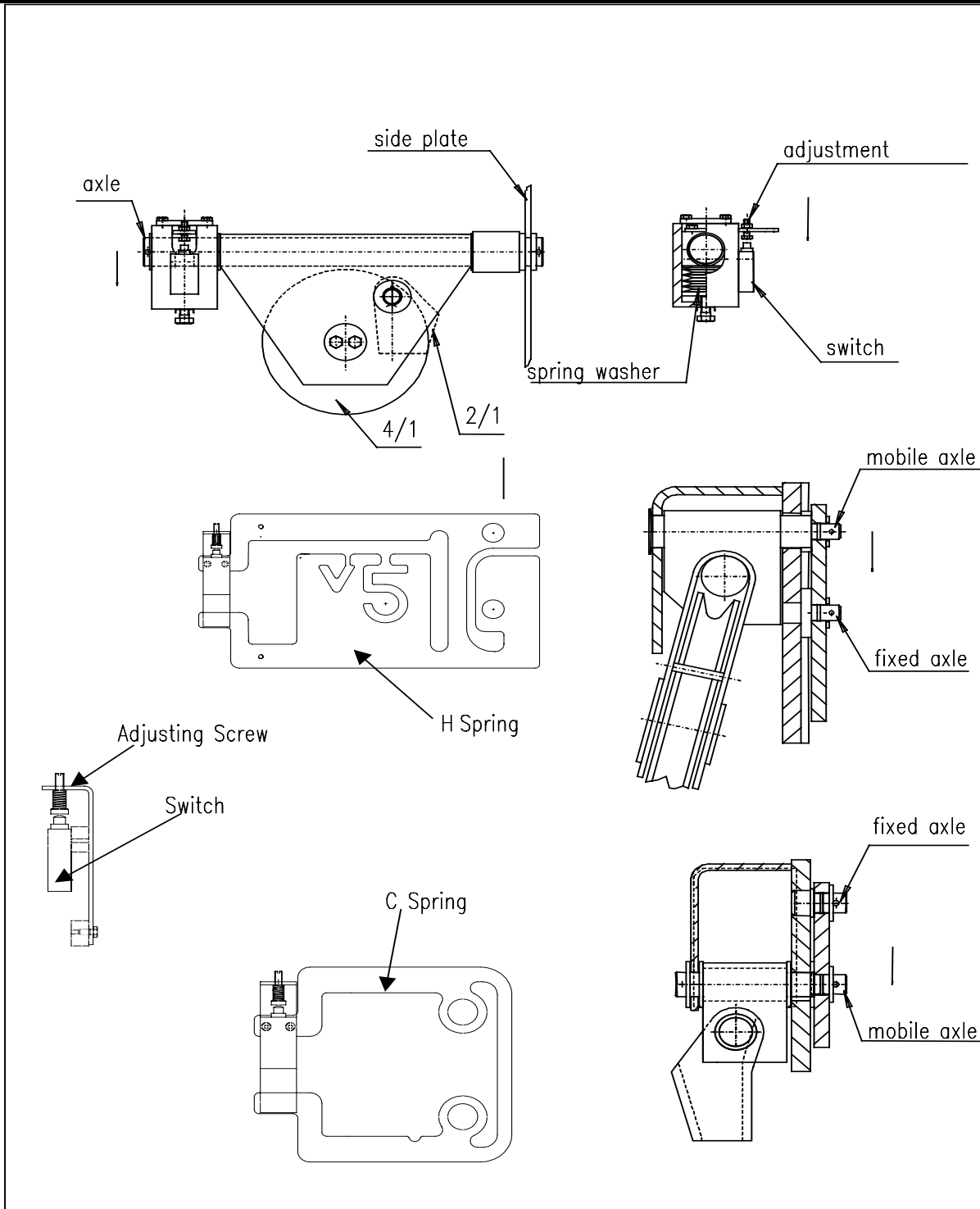
On hoist of type SM4, the load deforms a flat “spring” with a profile shape of “C” or “H”. This deformation likewise incurs a slight movement downward, with the same consequences as Belleville washer arrangement.

Hoist	Load	Spring type	Reference
SM4041..R	All	Profile H	V4LAB25A1
SM4041..F	All	Profile H	VSSA050B1
SM4122..F	All		YL0000
SM4162..F	All		YL0000

R = Low Headroom Trolley, F = Foot Mount. For double girder trolley, use F suspension arrangement.

LOAD LIMITER

12



HOIST LIMIT SWITCH

13

Gear limit switch - Stromag

Gear limit switch is a safety device and is mounted on the drum stud end of the hoist, coupled in line with the rope drum.

Specification of Micro-switch

$I_{th} = 3A$ $U_i = \text{max. } 250V \text{ AC}$ Enclosure rating IP-65

Contact connections:

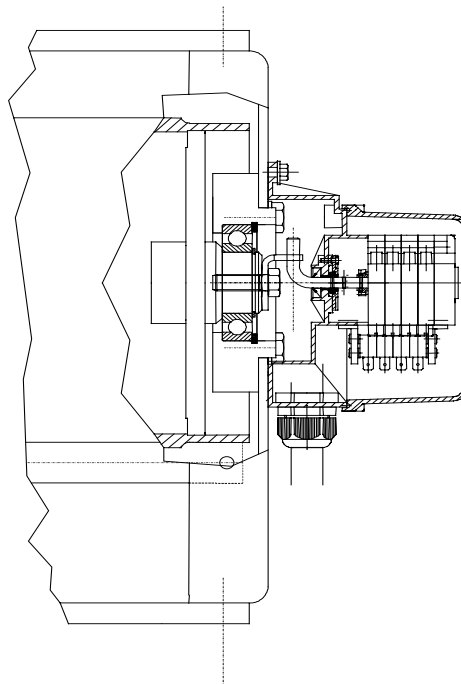
The wire connections to the micro-switches are made through flat terminals, 6.3x0.8mm. Contact 1 on the micro switch is always common. Contact 4 is normally open and contact 2 is normally closed. The micro-switch has single pole, double throw (SPDT) contacts.

Operation of gear limit switch

This gear limit switch is of the rotary cam type and is equipped with 4 micro-switches. Gear limit switch limits the lifting and lowering within the range of the highest and lowest rated hook position.

Position from shaft	Switch Identification	Function
1	S1	Lift
2	S2	Lower
3	S3	Not used
4	S4	Not used

The switches on gear limit are pre-set at the factory. Switches S1 and S2 are set for extreme upper and lower limits. Limit switch, S1, stops the lifting when the hoist rope has attained the maximum number of windings on the drum and when the hook is at its upper limit of travel as determined by rated headroom. Limit switch S2, stops the lowering when the hook is at its lower limit of travel as determined by rated lift where no less than two wraps of rope shall remain on each anchorage of the hoist rope drum. Switches S3 and S4 are not normally used.



SURFACE TREATMENT

14

Steel parts

Preliminary treatment: Steel parts are shot blasted all over with steel particles. All rust and foreign particles are removed and the blast dust is cleaned away. If necessary, the surface of thin steel plates is ground to guarantee paint adhesion.

Primary paint:

- Primary painting is done by spray painting. Painting, drying time and temperature are chosen according to the paint manufactures instructions.
- MONO-COMPONENT REACTIF PRIMER PAINT, one layer, 30um.

Finishing paint: - Finishing painting is done by spray painting. Painting, drying time and temperature are chosen according to the paint manufactures instructions.

- ACRYLIQUE POLYURETHANE, one layer 50 um color Black RAL 9004 (cover and cubicle are yellow RAL1021, nominal equivalent Sherwin-Williams F77Y32698-1242)

Total paint thickness: 80 um

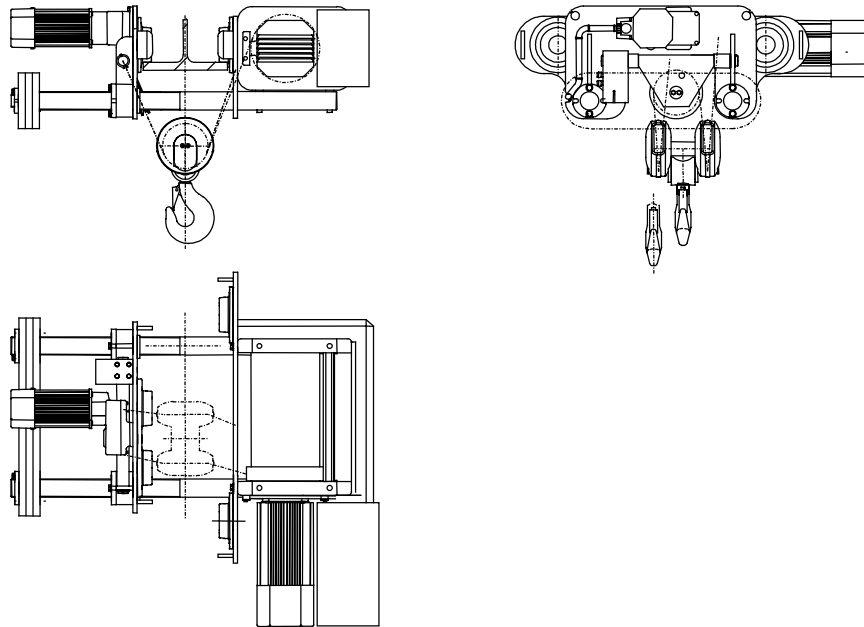
Hoisting and traveling motors

The aluminum frame is anodized to black

Hoisting and traveling gear boxes

The gearboxes are painted Black Gray RAL 7021.

TROLLEY	15
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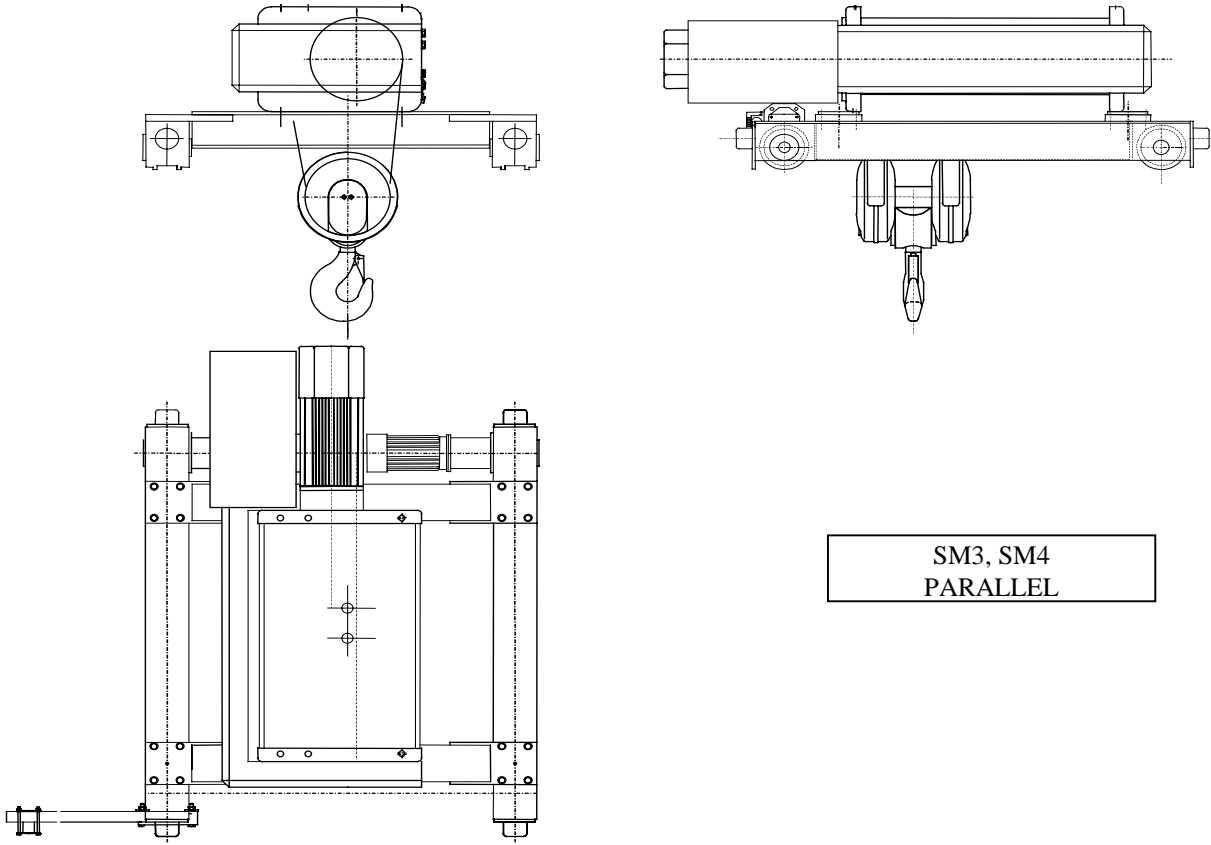
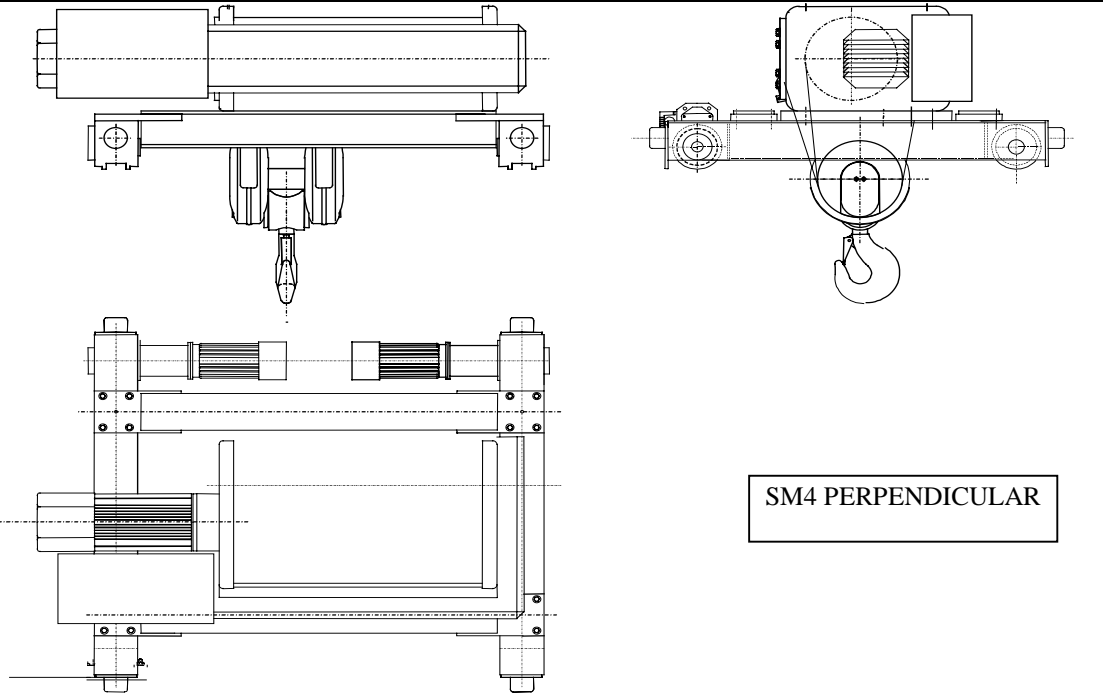
LOW HEADROOM TROLLEY HOIST

MONORAIL FLANGE RANGES - LOW HEADROOM TROLLEY

Hoist	Min. Flange Width mm (inch)	Max. Flange Width mm (inch)	Tread width mm	Wheel ϕ mm	Wheel Hardness BHN (ductile iron)
SM1	98 (3.86)	360 (14.17)	25	100	187-255 BHN
SM2, SM3	98 (3.86)	500 (19.69)	30	125	187-255 BHN
SM4	150 (5.91)	500 (19.69)	40	160	187-255 BHN

The low headroom trolley, denoted by the letter R in SM hoist code, travels on bottom flange of a single girder crane or monorail. Headroom is minimized by having the trolley located beside the hoist. The flange setting for low headroom trolleys is adjustable through the complete flange width range. Wheels are a single flange type and are crown tread suitable for flat or tapered beam flange. Gear teeth are integrally cut into the flange of the drive wheel. Wheel bearings are shielded and life time lubricated. Trolleys have safety drop lugs and a provision for bumpers. Drive wheels are pinion driven.

TROLLEY	15
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TROLLEY

15

Double Girder Trolley

Hoist	DGT Arrangement	Rail gauge (mm)	Whl ϕ (mm)	Whl groove Width (mm)	D. I. Wheel Hardness BHN
SM30411.P12ALN2	Parallel	1200	90	65	241-302
SM30411.P12ANN3	Parallel	1200	90	65	241-302
SM30411.P12ARN3	Parallel	1200	90	65	241-302
SM30411.P12CLN2	Parallel	1200	90	65	241-302
SM30411.P12CNN3	Parallel	1200	90	65	241-302
SM30411.P12CRN3	Parallel	1200	90	65	241-302
SM40411.P12BLN3	Parallel	1200	140	65	241-302
SM40411.P12BNN4	Parallel	1200	140	65	241-302
SM40411.P12BRN4	Parallel	1200	140	65	241-302
SM40411.P12DLN3	Parallel	1200	140	65	241-302
SM40411.P12DNN4	Parallel	1200	140	65	241-302
SM40411.P12DRN4	Parallel	1200	140	65	241-302
SM41221.C14ENN3	Perpendicular	1400	140	65	241-302
SM41221.C14ERN4	Perpendicular	1400	140	65	241-302
SM41621.C20GRN4	Perpendicular	2000	200	65 or 80	241-302

The parallel DGT arrangement, denoted by the letter P in SM hoist code, is where the hoist drum is parallel to the bridge girders. The perpendicular DGT arrangement, noted by the letter C in SM hoist code, is where the hoist drum is perpendicular to the bridge girders. The hoist mounts on top side of the double girder trolley. DGT wheels are double flanged and flat tread. Drive wheels are rotating axle. Idler wheels are stationary axle.

TRAVELING SPEED	16
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Monorail traveling speed (50 Hz):

Hoist	Wheel Ø mm	speed m/min	Motor power KW x 3000/750 RPM	Gear box type	Number of motor	Number of Driven Whl
SM10411.R	100	20 / 5	0.25/0.06	DS315RPC	1	2
SM20411.R	125	20 / 5	0.25/0.06	DS315RPC	1	2
SM30411.R (<= 5t)	125	20 / 5	0.25/0.06	DS315RPC	1	2
SM40411.R (<= 10t)	160	20 / 5	0.25/0.06	DS320RPC	2	2

Capacity mentioned is metric ton.

Monorail traveling speed (60 Hz):

Hoist	Wheel Ø mm	speed fpm	Motor power HP x 3600/900 RPM	Gear box type	Number of motor	Number of Driven Whl
SM10411.R	100	80/20	1/2	DS315RPC	1	2
SM20411.R	125	80/20	1/2	DS315RPC	1	2
SM30411.R (<= 5t)	125	80/20	1/2	DS315RPC	1	2
SM40411.R (<= 10t)	160	80/20	1/2	DS320RPC	2	2

Capacity mentioned is metric ton.

Double girder traveling speed (50 Hz):

Hoist	End truck type	Speed m/min	Motor power KW x 3000/750 RPM	Gear box type	Number of motor	Number of Driven Whl
SM30411	HK09	20 / 5	0.45 / 0.11	DS240RPD	1	2
SM40411	HK14	20 / 5	0.45 / 0.11	DS363RPB	2	2
SM41221		20 / 5	0.45 / 0.11	DS363RPB	2	2
SM41621	6DAA	20 / 5	0.45 / 0.11	TM490	2	2

Double girder traveling speed (60 Hz):

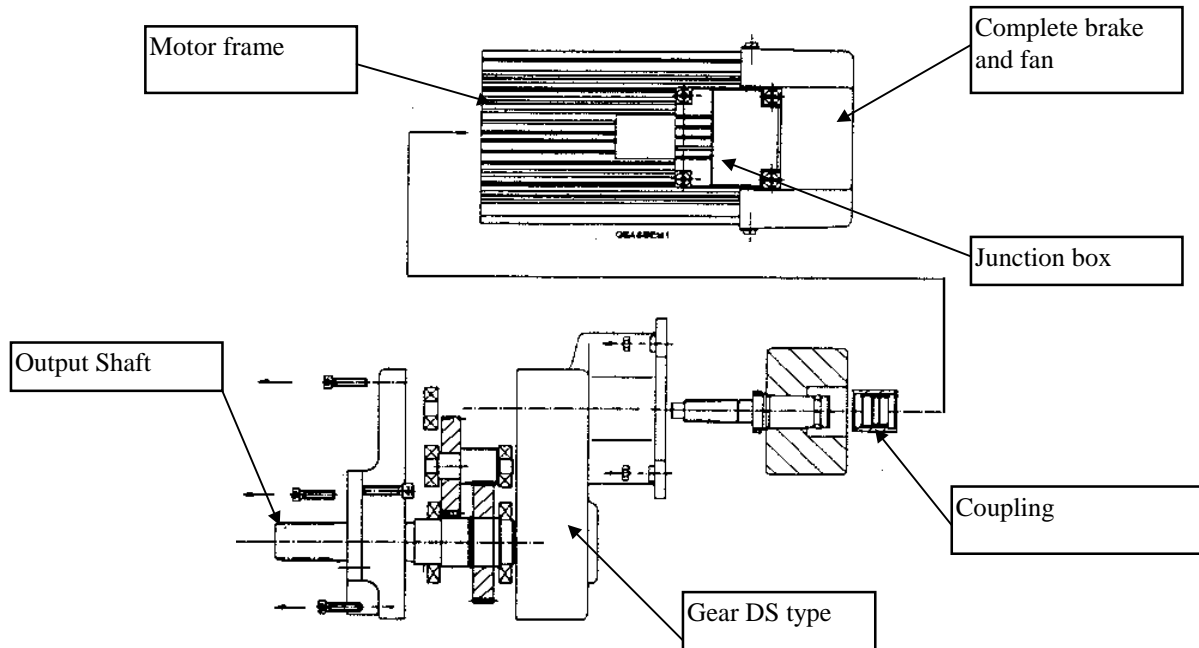
Hoist	End truck type	Speed fpm	Motor power HP x 3600/900 RPM	Gear box type	Number of motor	Number of Driven Whl
SM30411	HK09	80/20	3/4	DS240RPD	1	2
SM40411	HK14	80/20	3/4	DS363RPB	2	2
SM41221		80/20	3/4	DS363RPB	2	2
SM41621	6DAA	80/20	3/4	TM490	2	2

TRAVELING MOTORS

17

1) DESCRIPTION

The drive consists of a motor and a brake, and with different ratio gearbox combinations. Due to the modular design, the motor can be replaced without dismounting the gearbox from the end truck.



TRAVELING MOTORS

17

2) MOTORS

All the traveling motors incorporate D.C. disc brake, class F insulation and an IP55 degree of protection as standard. The stator frame is made of extruded aluminum profile to maximize the dissipation of heat. The frame has a black anodized finish. MF07 motors have a CSA rating and a plug in connector.

Characteristics of traveling motors (50 hertz):

Motor type (50 hertz)	Power	Synchron ous speed	Max. torque	Starting torque	Electric braking torque	Short time duty High/ slow	Braking torque
Unit	kW	RPM	Nm	Nm	Nm	min	Nm
MF07LA104	0.25/0.06	3000/750	2.2/1.4	2.2/1.4	2.8/2.7	cont./50	2
MF07LB104	0.45/0.11	3000/750	3.3/2.4	3.3/2.4	5.7/5.1	cont./30	2.6
MF07ZC104	0.65/0.15	3000/750	5.3/3.5	5.2/3.5	10.7/9.2	cont./20	4
MF09LB206	0.65/0.15	1500/500	9.7/6.8	8.8/6.8	18.2/12.5	30/30	9
MF10L-206	1.1/0.35	1500/500	16.7/12.8	14.8/12.8	27.7/20.6	30/15	16
MF09LB104	1.3/0.3	3000/750	8/7.5	8/7	23.8/14	cont./60	9
MF10L-104	2.2/0.55	3000/750	18/12	18/12	48.1/21.6	30/20	16
MF11LB-206	1.8/0.5	1500/500	30/22	24/22	48/31		30

Characteristics of traveling motors (60 hertz):

Motor type (60 hertz)	Power	Synchron ous speed	Max. torque	Starting torque	Electric braking torque	Short time duty High/ slow	Braking torque
Unit	HP	RPM	Nm	Nm	Nm	min	Nm
MF07LA104	0.5/0.1	3600/900	2.3/1.4	2.3/1.4	2.8/2.7	30/30	2
MF07LA100	1/2	3600		2.1	-	30/30	2
MF07LB104	0.75/0.18	3600/900	3.3/2.2	3.3/2.2	5.7/5.1	30/30	2.6
MF07LB100	3/4	3600		3.7	-	30/30	2.6
MF07ZC104	1/0.24	3600/900	5.8/3.5	5.7/3.5	10.7/9.2	30/15	4
MF07ZC100	1	3600		6.9	-	30/30	4
MF09LB206	1/0.24	1800/600	9.5/6.7	8.6/6.7	18.2/12.5	30/30	9
MF09LA200	2	1800					
MF10L-206	1.75/0.53	1800/600	15.7/12.6	13.9/12.6	27.7/20.6	30/15	16
MF09LB104	2/0.5	3600/900	8/7.5	8/7	23.8/14		9
MF10L-104	3.3/0.8	3600/900	17.7/12	17.7/12	48.1/21.6	30/20	16
MF11LB-206	2.9/0.9	1800/600	30/22	24/22	48/31		30

TRAVELING MOTORS	17
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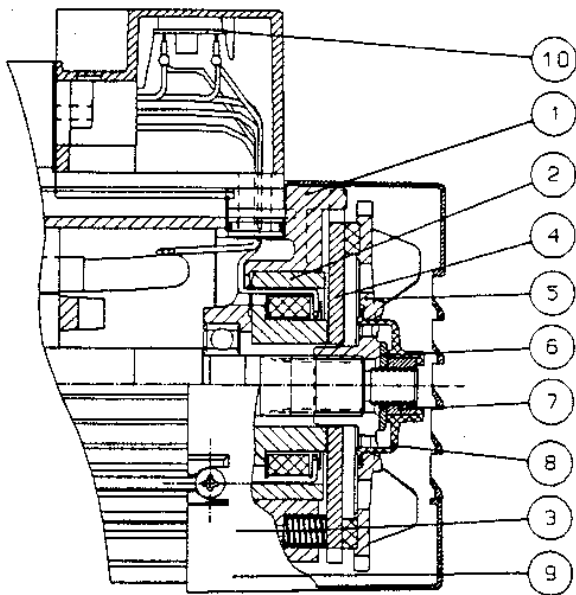
Motor Current & Brake Voltage - 60 Hz

Motor type	HP	RPM		230 V	460 V	575 V
MF07LA104	0.5/0.1	3600/900	Nominal current (A)	2.6/1.3	1.3/0.8	1.1/0.1
			Starting current (A)	7.0/1.5	3.5/0.76	2.8/0.6
			Brake coil VDC	190	190	220
MF07LA100	1/2	3600	Nominal current (A)	2.2	1.1	0.9
			Brake coil VDC	190	190	220
MF07LB104	0.75/0.18	3600/900	Nominal current (A)	3.4/1.8	1.7/0.9	1.3/0.7
			Starting current (A)	11.2/4.4	5.6/2.2	4.5/1.8
			Brake coil VDC	190	190	220
MF07LB100	3/4	3600	Nominal current (A)	2.6	1.3	1.1
			Brake coil VDC	190	190	220
MF07ZC104	1/0.24	3600/900	Nominal current (A)	3.6/2.7	1.9/1.4	1.5/1.1
			Starting current (A)	17.2/3.4	8.6/1.7	6.9/1.4
			Brake coil VDC	190	190	220
MF07ZC100	1	3600	Nominal current (A)	3.4	1.7	1.4
			Brake coil VDC	190	190	220
MF09LB206	1/0.24	1800/600	Nominal current (A)	4/3.4	2.0/1.7	1.6/1.36
			Starting current (A)	14.8/4.0	7.4/2.0	5.92/1.6
			Brake coil VDC	190	190	220
MF09LA200	2	1800	Nominal current (A)	6.2	3.1	2.5
			Brake coil VDC	190	190	220
MF10L-206	1.75/0.53	1800/600	Nominal current (A)	6.2/4.2	3.1/2.1	2.48/1.68
			Starting current (A)	24/6.6	12/3.3	9.6/2.64
			Brake coil VDC	190	190	220

TRAVELING MOTORS	17
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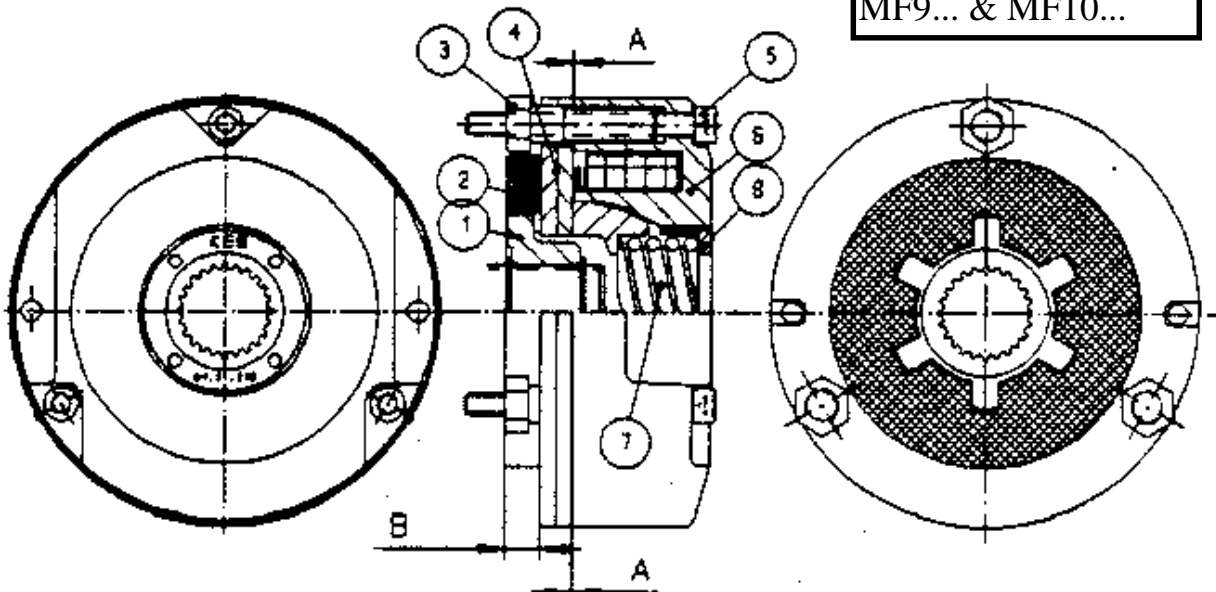
3) BRAKES

MF07 ...



- | | |
|------------------|--------------------|
| 1 - End bell | 2 - Brake magnet |
| 3 - Brake spring | 4 - Armature disc |
| 5 - Brake wheel | 6 - Washer |
| 7 - Nut | 8 - Locking device |
| 9 - Fan cover | 10 - Rectifier |

MF9... & MF10...



- | | |
|---------------------|----------------------------|
| 1 - brake disc | 2 - friction disc |
| 3 - adjustment nut | 4 - armature disc |
| 5 - retaining screw | 6 - brake magnet |
| 7 - brake spring | 8 - torque adjustment ring |

TRAVELING MOTORS	17
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3) BRAKES

Springs hold the brake closed until the coil is energized and the brake opens. The brake closes immediately in case of power failure.

Motor type	Brake type	brake torque (Nm)	Lining thickness (mm)	min. lining thickness (mm)	Nominal air gap (mm)	Max allowable air gap (mm)
MF07LA	NM311NR*	2	4	0.9	0.4	0.9
MF07LB	NM312NR*	2.6	4	0.9	0.4	0.9
MF07ZC	NM313NR*	4	4	0.9	0.4	0.9
MF09	NM34003	4	9	5.3	0.2	0.5
MF09	NM34003A	9	9	5.3	0.2	0.5
MF09	NM34004	16	12	7.3	0.2	0.5
MF10	NM34005	16	12	6	0.3	0.7
MF10	NM34005A	32	12	6	0.3	0.7

* 2 = 190VDC, 3 = 220VDC.

4) GEARS

All gears run on life-time lubricated bearings in a totally enclosed aluminum gearbox with semi-fluid grease lubrication.

Main characteristics:

GEAR	MOTOR POWER Max. (50 Hz) kW	Ratio available min-max	DRIVEN SHAFT		
			D (mm)	specification	Type
DS1	0.2	9-20	25	pin	C
DS3	0.45	7-80	25	pin	C
DS4	0.45	7-50	25	pin	C
DS2	0.25	20-63	21.8	W22*1.25*16*8f DIN5480	SPLINE
DS3	0.45	9-80	29.7	W30*1.5*18*8f DIN5480	SPLINE
DS4	0.45	20-50	29.7	W30*1.5*18*8f DIN5480	SPLINE
TM4	0.75	28-90	45.5	N45*2*21 DIN5480	HOLLOW with SPLINE
TM5	5.0	14-90	45.5	N45*2*21 9H DIN5480	HOLLOW with SPLINE

CONTROLS	18
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- SOLO hoist controls:

A solo hoist is a hoist that travels on a monorail rather than a traveling crane. The controls include:

- Push button pendant with a emergency “ STOP “ button,
- hoist contactors or inverter,
- brake and thermistor monitoring module,
- brake control rectifier,
- trolley contactors + thermal overload relays or inverter,
- 115V control voltage transformer,
- mainline contactor.
- plug for mainline power connection only on hoists with N1 or N2 hoist motors,
- plug for pendant connection on hoists with N1, N2 or N3 hoist motors only.

SM2000 Solo Hoist Plug Connection Summary

Motor	Hoist power at Hoist Panel	Pendant at Hoist Panel
N1/N2	Plug connection	Plug connection
N3	Hardwire connection	Plug connection
N4	Hardwire connection	Hardwire connection

- QC2000 Modular crane & hoist controls:

A Spacemaster 2000 hoist, operating on a modular crane has controls including:

- hoist motor contactors or inverter,
- brake and thermistor monitoring module,
- brake control rectifier,
- trolley motor contactors + thermal overload relays or inverter,
- 115V control voltage rating.
- plug for hoist power festoon connection.
- plug for control festoon connection.

QC2000 modular crane controls include:

- bridge motor contactors + thermal overload relays or inverter,
- control transformer 115V for 60 hertz,
- through-door mainline disconnect switch with fuses
- mainline contactor
- pushbutton pendant mounted on separate sliding festoon rail on the crane.
- plugs for festoon connections.
- plug for mainline power connection for hoists with N1, N2 or N3 hoist motors only.

QC 2000 Plug Connection Summary

Motor	Hoist power	Pendant	Crane motor festoon	Mainline
N1/N2	Plug connection	Plug connection	Plug connection	Plug connection
N3	Plug connection	Plug connection	Plug connection	Plug connection
N4	Plug connection	Plug connection	Plug connection*	Hardwire connection

*MF07 motor only.

MATERIAL	19
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FRAME

Item	Material		Surface Finish
	Nom. Equivalent USA	ISO	
Hoisting Motor Frame	UNS A96063	Aluminum SFS2591	anodized
Motor Brake Cover	Plastic	Plastic	without
Coupling Motor/Gear		Fe510D	Black
Hoisting Gear case	Ductile A536 85-55-06	600	EPOXY paint
Drum tube		Fe510D	without
Rope Guide	Ductile A536 85-55-06	500	EPOXY paint
Clamps		Fe510D	without
Sheave	Ductile A536 85-55-06	600	POLYURETHANE paint
Sheave pin		Fe510D	without
Rope Anchor	Ductile A536 65-45-12	400	POLYURETHANE paint
Wedge for wire rope	Ductile A536 65-45-12	400	without
Wedge housing pin	ANSI 4140	42CrMo4	without
Hoist frame		Fe510D	POLYURETHANE paint
Hook block frame		Fe510D	POLYURETHANE paint
Hook block beam	ANSI 4140	42CrMo4	POLYURETHANE paint
Hook	ANSI 4145	34CrMo4	POLYURETHANE paint

Nominally Equivalent USA materials are listed as reference only.

TROLLEY

Item	Material		Surface Finish
	Nom. Equivalent USA	ISO	
Traveling motor. (frame)	UNS A96063	Aluminum SFS2591	anodized
Traveling Brake Cover	Plastic	Plastic	without
Coupling motor/gear	composite	composite	without
Traveling gear housing	No equivalent	Aluminum SFS2567	EPOXY paint
Trolley frame		Fe510D	POLYURETHANE paint
Tie bolt		Fe510D	zinc coating
Counter weight	ASTM A36	FE360B	POLYURETHANE paint
PX90 frame		Fe430B	POLYURETHANE paint
PX110 frame		Fe430B	POLYURETHANE paint
PX140 frame		Fe430B	POLYURETHANE paint
PX200 frame		Fe510D	POLYURETHANE paint
DGT End truck wheel	Ductile A536 100-70-03	700	without
End carriage wheel shaft		Fe510D	without
Monorail wheel	Ductile A536 85-55-06	600	POLYURETHANE paint
Monorail wheel shaft	AISI 1049	C48	without

Nominally Equivalent USA materials are listed as reference only.

BEARING	20
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Location/Hoist	SM1	SM2	SM3	SM4
Drum gear side	needle roller bearing (not sealed)	needle roller bearing (not sealed)	needle roller bearing (not sealed)	needle roller bearing (not sealed)
drum opposite/gear	deep groove ball bearing (sealed)	deep groove ball bearing (sealed)	deep groove ball bearing (sealed)	Spherical roller bearing (sealed)
Low Headroom trolley wheel	deep groove ball bearing (sealed)	deep groove ball bearing (sealed)	deep groove ball bearing (sealed)	deep groove ball bearing (sealed)
Double girder Trolley wheel	-	-	deep groove ball bearing double shielded	deep groove ball bearing double shielded
Hook 4/1 1Am	thrust ball bearing	thrust ball bearing	thrust ball bearing	Cylindrical Roller thrust bearing
Hook 4/1 2m/3m	thrust ball bearing	thrust ball bearing	cylindrical roller thrust bearing	cylindrical roller thrust bearing
Hook TVL 12/2, 16/2	-	-	-	Cylindrical roller Thrust bearing
Sheave 1Am 4/1	deep groove ball bearing (sealed)	cylindrical roller bearing (not sealed)	cylindrical roller bearing (not sealed)	cylindrical roller bearing (not sealed)
Sheave 2m/3m 4/1	deep groove ball bearing (sealed)	cylindrical roller bearing (not sealed)	cylindrical roller bearing (not sealed)	cylindrical roller bearing (not sealed)
Sheave 1Am 12/2, 16/2	-	-	-	Deep groove ball Bearing Double shielded

CONVERSIONS

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Conversion of SI Units to U.S. Customary Units

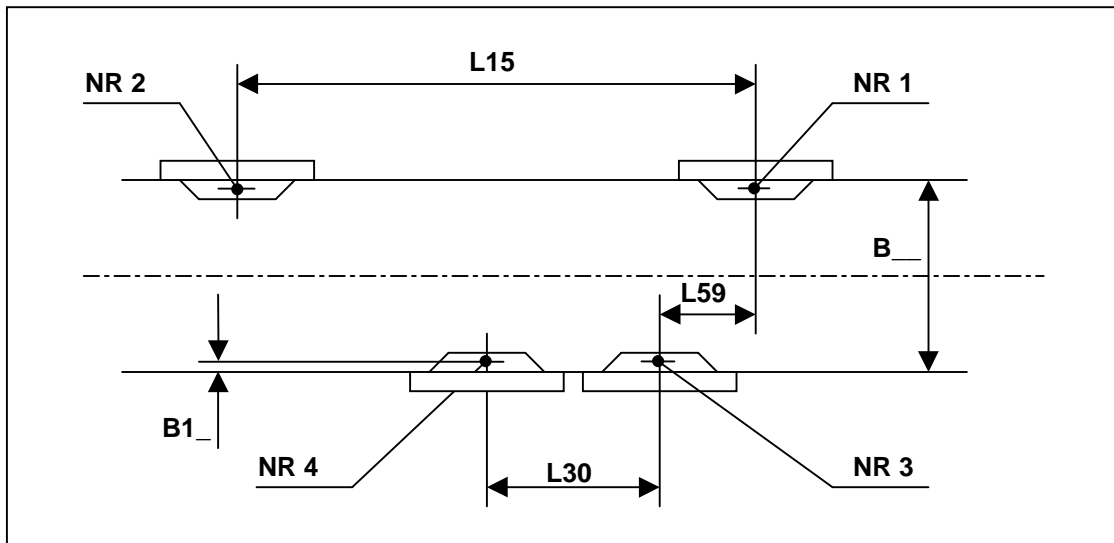
To convert from	To	Multiply by Common
Kilogram (Kg)	pound mass (lbm)	2.205
Kilogram (Kg)	ton (2000 lbm)	0.0011
Kilowatt (kW)	horsepower (hp)	1.34
Meter (m)	foot (ft)	3.28
Millimeter (mm)	inch (in)	0.03937
Newton-meter (N-m)	foot-pound-force (ft-lb)	0.737

R&M Materials Handling, Inc. has made every effort to make this Technical Guide complete and accurate as of the time of printing. Since products are continuously being improved, all data is subject to change and correction. The data presented here is for general information to provide an overview of capabilities of Spacemaster 2000 hoists and their components. For specific applications, certified dimensions, capabilities and performance data, contact appropriate person on the Key Contact Listing.

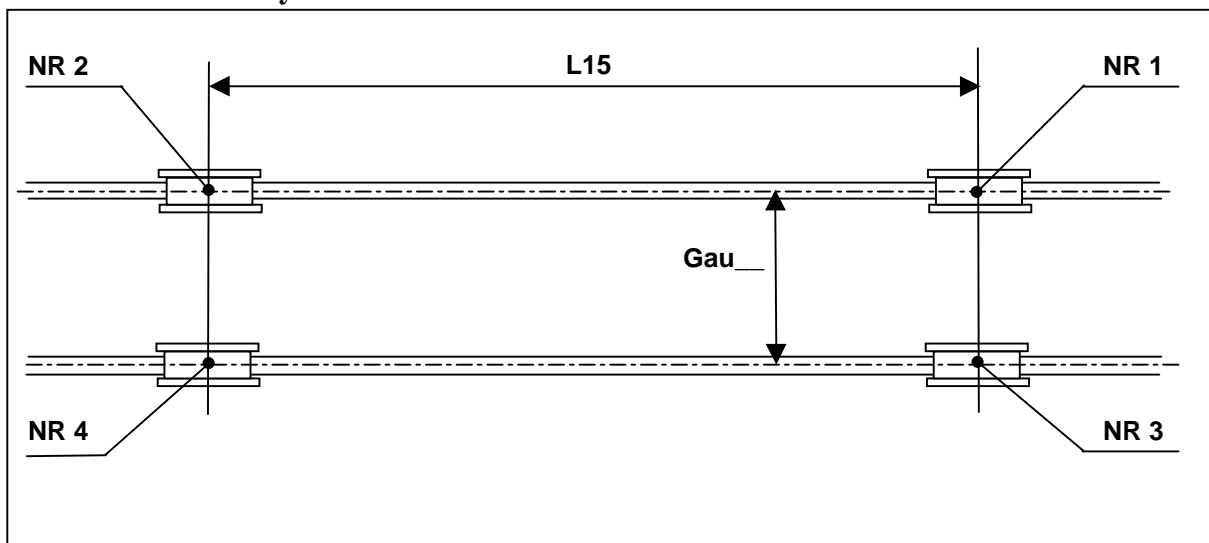
TROLLEY WHEEL LOAD	22
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Wheel load values listed in following tables are static and do not include impact allowances. Load values are for each wheel as shown below for monorail or double girder trolley. The unit of measure for wheel load values in these tables is pounds (lbs.) for hoist with capacity ratings in US ton and kilogram (kg) for hoist with metric capacity ratings. All trolley dimensions listed in these tables, regardless of capacity rating, are in millimeters (mm).

Monorail Trolley



Double Girder Trolley



TROLLEY WHEEL LOAD	22
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Low Headroom Monorail Trolley Hoist with US Capacity Rating

Cap. Ton	Model	NR1 Lbs.	NR2 Lbs.	NR3 Lbs.	NR4 Lbs.	Wheel qty	Wheel Ø, mm	L15 mm	L30 mm	L59 mm
1	SM104116...ANN1	348	1038	583	583	4	100	690	170	48
1.5	SM104115...ANN1	365	1481	853	853	4	100	690	170	48
2	SM104114...ANN1	407	1936	1104	1104	4	100	690	170	48
	SM204116...ANN2	1832	801	1136	1136	4	125	740	224	-23
	SM204116...CNN2	1990	723	1153	1153	4	125	950	224	-23
3	SM204115...ANN2	2538	1092	1637	1637	4	125	740	224	-23
	SM204115...CNN2	2760	949	1654	1654	4	125	950	224	-23
5	SM304114...ALN2	4002	1692	2710	2710	4	125	740	224	-23
	SM304114...ARN3	4089	1729	2681	2681	4	125	740	224	-23
	SM304114...CLN2	4309	1398	2736	2736	4	125	950	224	-23
	SM304114...CRN3	4391	1411	2722	2722	4	125	950	224	-23
	SM304115...ANN3	4071	1688	2710	2710	4	125	740	224	-23
	SM304115...CNN3	4438	1466	2671	2671	4	125	950	224	-23
7.5	SM404115...BLN3	3340	5824	4164	4164	4	160	838	395	104
	SM404115...BRN4	3343	5738	4249	4249	4	160	838	395	104
	SM404115...DLN3	2898	6266	4164	4164	4	160	1238	395	104
	SM404115...DRN4	2873	6208	4249	4249	4	160	1238	395	104
	SM404116...BNN4	3343	5738	4249	4249	4	160	838	395	104
	SM404116...DNN4	2873	6208	4249	4249	4	160	1238	395	104
10	SM404114...BLN3	7063	4298	5438	5438	4	160	838	395	104
	SM404114...BRN4	7066	4212	5524	5524	4	160	838	395	104
	SM404114...DLN3	3750	7868	5420	5420	4	160	1238	395	104
	SM404114...DRN4	3725	7810	5505	5505	4	160	1238	395	104
	SM404115...BNN4	4077	7497	5503	5503	4	160	838	395	104
	SM404115...DNN4	3366	8082	5566	5566	4	160	1238	395	104

TROLLEY WHEEL LOAD	22
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Double Girder Trolley – Parallel Hoist with US Capacity Rating

Cap. Ton	Model	NR1 Lbs.	NR2 Lbs.	NR3 Lbs.	NR4 Lbs.	Wheel qty	Wheel Ø, mm	L15 mm	Gage mm	Wgt. Lbs.
5	SM304114...ALN2	3131	2224	3221	2288	4	90	1100	1200	864
	SM304114...ARN3	3161	2224	3254	2291	4	90	1100	1200	930
	SM304114...CLN2	3243	2110	3338	2172	4	90	1400	1200	864
	SM304114...CRN3	3272	2114	3369	2176	4	90	1400	1200	930
	SM304115...ANN3	3161	2224	3254	2291	4	90	1100	1200	930
	SM304115...CNN3	3272	2114	3369	2176	4	90	1400	1200	930
7.5	SM404115...BLN3	4632	3316	4881	3492	4	140	1200	1200	1323
	SM404115...BRN4	4687	3322	4919	3486	4	140	1200	1200	1410
	SM404115...DLN3	4881	3067	5143	3232	4	140	1500	1200	1323
	SM404115...DRN4	4934	3075	5176	3225	4	140	1500	1200	1410
	SM404116...BNN4	4687	3322	4919	3486	4	140	1200	1200	1410
	SM404116...DNN4	4934	3075	5176	3225	4	140	1500	1200	1410
10	SM404114...BLN3	6164	4125	6609	4425	4	140	1200	1200	1323
	SM404114...BRN4	6219	4131	6645	4416	4	140	1200	1200	1410
	SM404114...DLN3	6460	3829	6927	4105	4	140	1500	1200	1323
	SM404114...DRN4	6512	3838	6930	4101	4	140	1500	1200	1410
	SM404115...BNN4	6096	4321	6433	4559	4	140	1200	1200	1410
	SM404115...DNN4	6426	3993	6781	4213	4	140	1500	1200	1410

Double Girder Trolley – Perpendicular Hoist with US Capacity Rating

Cap. Ton	Model	NR1 Lbs.	NR2 Lbs.	NR3 Lbs.	NR4 Lbs.	Wheel qty	Wheel Ø, mm	L15 mm	Gage mm	Wgt. Lbs.
15	SM412214...ENN3	7737	8506	7561	8312	4	140	800	1400	962
	SM412214...ERN4	7777	8574	7540	8313	4	140	800	1400	999
20	SM416214...GLN4	9609	12201	9403	11939	4	200	900	2000	1430

TROLLEY WHEEL LOAD	22
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Low Headroom Monorail Trolley Hoist with Metric Capacity Rating

Cap. Kg	Model	NR1 Kg.	NR2 Kg.	NR3 Kg.	NR4 Kg.	Wheel qty	Wheel Ø, mm	L15 mm	L30 mm	L59 mm
1000	SM104116...ANN1	46	612	291	291	4	100	690	170	48
1600	SM104115...ANN1	187	786	438	438	4	100	690	170	48
2000	SM104114...ANN1	205	969	538	538	4	100	690	170	48
	SM204116...ANN2	893	383	567	567	4	125	740	224	-23
	SM204116...CNN2	968	342	576	576	4	125	950	224	-23
3200	SM204115...ANN2	1317	558	867	867	4	125	740	224	-23
	SM204115...CNN2	1431	479	876	876	4	125	950	224	-23
5000	SM304114...ALN2	1971	819	1358	1358	4	125	740	224	-23
	SM304114...ARN3	2012	839	1343	1343	4	125	740	224	-23
	SM304114...CLN2	2120	672	1371	1371	4	125	950	224	-23
	SM304114...CRN3	2165	687	1357	1357	4	125	950	224	-23
	SM304115...ANN3	2024	866	1322	1322	4	125	740	224	-23
	SM304115...CNN3	2202	732	1315	1315	4	125	950	224	-23
	8000	SM404115...BLN3	1839	3150	2071	2071	4	160	838	395
SM404115...BRN4		1833	3107	2115	2115	4	160	838	395	104
SM404115...DLN3		1632	3357	2071	2071	4	160	1238	395	104
SM404115...DRN4		1612	3328	2115	2115	4	160	1238	395	104
SM404116...BNN4		1833	3107	2115	2115	4	160	838	395	104
SM404116...DNN4		1612	3328	2115	2115	4	160	1238	395	104
10000		SM404114...BLN3	3611	2202	2601	2601	4	160	838	395
	SM404114...BRN4	3605	2159	2646	2646	4	160	838	395	104
	SM404114...DLN3	1998	3968	2575	2575	4	160	1238	395	104
	SM404114...DRN4	1978	3939	2619	2619	4	160	1238	395	104
	SM404115...BNN4	2128	3812	2615	2615	4	160	838	395	104
	SM404115...DNN4	1849	4091	2615	2615	4	160	1238	395	104

TROLLEY WHEEL LOAD	22
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Double Girder Trolley – Parallel Hoist with Metric Capacity Rating

Cap. Kg.	Model	NR1 Kg.	NR2 Kg.	NR3 Kg.	NR4 Kg.	Wheel qty	Wheel Ø, mm	L15 mm	Gage mm	Wgt. Kg.
5000	SM304114...ALN2	1554	1103	1600	1135	4	90	1100	1200	392
	SM304114...ARN3	1568	1104	1614	1136	4	90	1100	1200	422
	SM304114...CLN2	1611	1046	1658	1077	4	90	1400	1200	392
	SM304114...CRN3	1624	1048	1672	1079	4	90	1400	1200	422
	SM304115...ANN3	1568	1104	1614	1136	4	90	1100	1200	422
	SM304115...CNN3	1624	1048	1672	1079	4	90	1400	1200	422
8000	SM404115...BLN3	2439	1743	2577	1842	4	140	1200	1200	600
	SM404115...BRN4	2463	1746	2593	1838	4	140	1200	1200	640
	SM404115...DLN3	2571	1610	2717	1702	4	140	1500	1200	600
	SM404115...DRN4	2595	1614	2732	1699	4	140	1500	1200	640
	SM404116...BNN4	2463	1746	2593	1838	4	140	1200	1200	640
	SM404116...DNN4	2595	1614	2732	1699	4	140	1500	1200	640
10000	SM404114...BLN3	3063	2048	3289	2200	4	140	1200	1200	600
	SM404114...BRN4	3088	2051	3305	2196	4	140	1200	1200	640
	SM404114...DLN3	3211	1900	3449	2040	4	140	1500	1200	600
	SM404114...DRN4	3235	1904	3463	2038	4	140	1500	1200	640
	SM404115...BNN4	3027	2145	3200	2268	4	140	1200	1200	640
	SM404115...DNN4	3191	1981	3374	2094	4	140	1500	1200	640

Double Girder Trolley – Perpendicular Hoist with Metric Capacity Rating

Cap. Kg	Model	NR1 Kg.	NR2 Kg.	NR3 Kg.	NR4 Kg.	Wheel qty	Wheel Ø, mm	L15 mm	Gage mm	Wgt. Kg.
15000	SM412214...ENN3	3848	4216	3768	4128	4	140	800	1400	960
	SM412214...ERN4	3866	4247	3759	4128	4	140	800	1400	1000
20000	SM416214...GLN3	4774	6047	4681	5928	4	140	900	2000	1430

UNDER RUNNING END TRUCKS	23
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End trucks UC and UT are for single girder, under running cranes where the wheels of the end trucks travel on the lower flange of the runway beams.

Structure

Side rails of UC trucks are structural steel tubes. The side plates for wheels are plate steel.

Wheels

The UC truck is equipped with four wheels where wheel side plates are rigidly attached to truck side rails. The UT truck is equipped with two four-wheel arrangements where side plates are connected to the truck beam using a pivot joint. The wheel is a single flange type and the material is ductile iron. The diameter of wheel tread is available in three sizes and tread is crown type suitable for flat or tapered beam flange. Wheel bearings are deep groove ball type and shielded. Bearings are lifetime lubricated. A pinion drives the drive wheels.

Joint Plate

The joint plate is used to connect the bridge beam to the end trucks. Joint plates are furnished as standard on UC type end trucks only. Joint plate is a bolted connection to end truck and it is available in two sizes, C10 (A) and C10 (B), to accommodate two ranges of runway beam flange widths. Both joint plates will accommodate bridge beams with flange widths up to 330mm (13”) maximum. The joint plate for UT type end trucks is not available and is furnished by the crane fabricator.

End truck Dimensions

UC end trucks will allow for flange adjustments through two flange width ranges.

Truck	Wheel base mm	Wheel ø mm	Flange Adjust. Range mm (inch)	Flange thickness mm (inch)	Joint plate type	Wgt/truck Kg (lbs)	DI wheel Hardness BHN
UC10-22	2200	100	82-199 (3.25-7.81)	40 (1.57)	C10(A)	150 (331)	187-255
			200-330 (7.88-13)	40 (1.57)	C10(B)	167 (368)	187-255
UC13-22	2200	125	82-199 (3.25-7.81)	40 (1.57)	C10(A)	306 (675)	187-255
			200-330 (7.88-13)	40 (1.57)	C10(B)	322 (709)	187-255
UC16-22	2200	160	98-199 (3.88-7.81)	35 (1.38)	C10(A)	316 (695)	187-255
			200-330 (7.88-13)	35 (1.38)	C10(B)	332 (731)	187-255

Gear Motor

The gear motor (DS3, DS4) for UT or UC truck mounts to the wheel side plate of the truck by a bolted connection and the output shaft of the gear motor is fitted with a pinion. The horsepower requirement of the motor for each crane application determines whether the gear type is DS3 or DS4. In either case a MF07 type motor with plug junction box is used.

UNDER RUNNING TRUCKS	23
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Travel Speed

End truck	Crane Speed			
	UC10, 13, 16		UT16	
GEAR TYPE Type C output shaft Ø25 mm shaft	Motor 3000/750 RPM 50Hz M/MIN	Motor 3600/600 RPM 60Hz FPM	Motor 3000/750 RPM 50Hz M/MIN	Motor 3600/9000 RPM 60HZ FPM
DS307 / DS407	40/10	160/40	50/12	200/50
DS309 / DS409	32/8	130/33	40/10	160/40
DS313 / DS413	25/6.3	100/25	32/8	130/33
DS315 / DS415	20/6	80/20	25/6.3	100/25
DS320 / DS420	16/4	60/15	20/5	80/20
DS325 / DS425	12/3	50/13	16/4	60/15
DS332 / DS432	10/2.5	40/10	12/3	50/13
DS340 / DS440	---	---	10/2.5	40/10

TOP RUNNING TRUCKS	24
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CT and CH end trucks are for single or double girder, top running cranes where the end trucks travel on rails mounted on top of runway beams.

Structure

The CT truck is steel structural tube type and the CH truck is welded box type construction. The CT14 end truck uses a wheel box for the drive wheel and the wheel box is welded integrally into the structural tube. End trucks are equipped with bolt on rail sweeps to facilitate wheel removal.

Wheels

Wheels are available in four diameters and are furnished with double flanges. The wheel material is ductile iron and with a hardness range of 241-302 BHN. Wheel bearings for structural tube trucks are deep groove ball type, shielded and lifetime lubricated. Bearings for welded box type construction trucks are spherical roller type and require a recharging of grease. The drive wheel is coupled to a rotating axle by splines. On CT14, 20 and 25 end trucks, the bearings are mounted in the idler wheel and the wheel rotates on a stationary axle. On CT32 truck the idler wheel is coupled to a rotating axle by splines. The groove width of the wheel is specified as part of the end truck ordering code.

Endtruck	Wheel ø mm	Groove width range, mm	Standard groove width, mm	Optional groove width, mm
CT09	90	50-65	65	50
CT11	110	65	65	None
CT14	140	65	65	None
CT20	200	65-95	65	80
CT25	250	65-95	65	80
CH25	250	65-100	65	80
CH32	320	65-100	80	Specify

Joint Plate

The joint plate is furnished as standard and is used to connect bridge beam to end trucks. The joint plate is bolted to end truck. The type of joint plate depends on the end truck selected, beam profile, and type of connection. In most cases, in QC2000 modular crane packages, the suggested beam has a wide flange profile and is designated by the letter P. The mounting of the WF beam to the joint plate is available in three connection types. These types are low, medium (MED) or standard (STD). The low connection is where the under side of the top flange of a WF beam is mounted to a U- shaped plate. A medium connection is where the beam is coped and mounted to the joint plate. The standard connection is where the bottom flange of the beam is mounted to the joint plate. Connection drawings illustrate the requirements for each type of connection.

End truck	Joint plate	Type of connection	Max. flange width of beam on joint plate mm	Connection drawing
CT11 CT14	B6	Standard Medium Low	555	P-STD-B6 P-MED-B6 P-LOW-B6
CT20 CT25 CH32	H2	Standard Medium	410	P-STD-H2 P-MED-H2
CT20 CT25 CH32	M3	Low	430	P-LOW-M3

TOP RUNNING TRUCKS	24
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Gear Motor

The gear motor (DS3, DS4) for the CT14 truck mounts to the wheel box of truck by a bolted connection and the output shaft of the gear motor couples directly to the wheel. The required motor horsepower for each crane application determines whether the gear type is DS3 or DS4. The motor for the DS gear is MF07 type with a plug junction box. The hollow shaft gear motor (TM4, TM5) for CT20, CT25 and CH32 trucks mounts to the output shaft from the wheel. The motor for the TM4 gear is a MF07 type with a plug junction box. Motors for the TM5 gear are MF09, MF10 or MF11 type with a standard junction box. On delivery the torque arm for the TM gear motor requires some assembly. The gear motor is always ordered separately.

Travel Speed – CT14 Truck

End truck	Crane Speed	
	CT14	
GEAR TYPE Type P output shaft	Motor 3000/750 RPM 50Hz M/MIN	Motor 3600/600 RPM 60Hz FPM
DS307 / DS407	---	---
DS309 / DS409	---	---
DS313 / DS413	---	---
DS315 / DS415	---	---
DS320 / DS420	63/16	250/63
DS325 / DS425	50/12	200/50
DS332 / DS432	40/10	160/40
DS340 / DS440	32/8	130/33
DS350 / DS450	25/6.3	100/25

Travel Speed – CT20 & CT25 Trucks

End truck	Crane Speed			
	CT20		CT25	
GEAR TYPE Type P output shaft	Motor 3000/750 RPM 50Hz M/MIN	Motor 3600/600 RPM 60Hz FPM	Motor 3000/750 RPM 50Hz M/MIN	Motor 3600/9000 RPM 60HZ FPM
TM428	63/16	250/63	80/20	315/19
TM436	50/12	200/50	63/16	250/63
TM445	40/10	160/40	50/12	200/50
TM456	32/8	130/33	40/10	160/40
TM470	25/6.3	100/25	32/8	130/33
TM490	20/5	80/20	25/6.3	100/25
TM412 (112)	16/4	60/15	20/5	80/20

TOP RUNNING TRUCKS	24
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Travel Speed – CH25 & CH32 Trucks

End truck	Crane Speed			
	CH25		CH32	
GEAR TYPE Type P output shaft	Motor 3000/750 RPM 50Hz M/MIN	Motor 3600/600 RPM 60Hz FPM	Motor 3000/750 RPM 50Hz M/MIN	Motor 3600/9000 RPM 60HZ FPM
TM522	100/25	400/100	---	---
TM528	80/20	315/79	100/25	400/100
TM536	63/16	250/63	80/20	315/79
TM545	50/12	200/50	63/16	250/63
TM556	40/10	160/40	50/12	200/50
TM570	32/8	130/33	40/10	160/40
TM590	25/6.3	100/25	32/8	130/33

BUMPERS	25
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Bumpers are furnished and bolted to both ends of the end truck as standard. Bumpers are rubber or polyurethane, depending on the size of bumper required. The bumper size for each crane is selected case by case. Bumpers are specified as part of the (crane) end truck ordering code.

Bumpers, similar to those used on end trucks, are furnished and bolted to both monorail and double girder trolleys as standard.