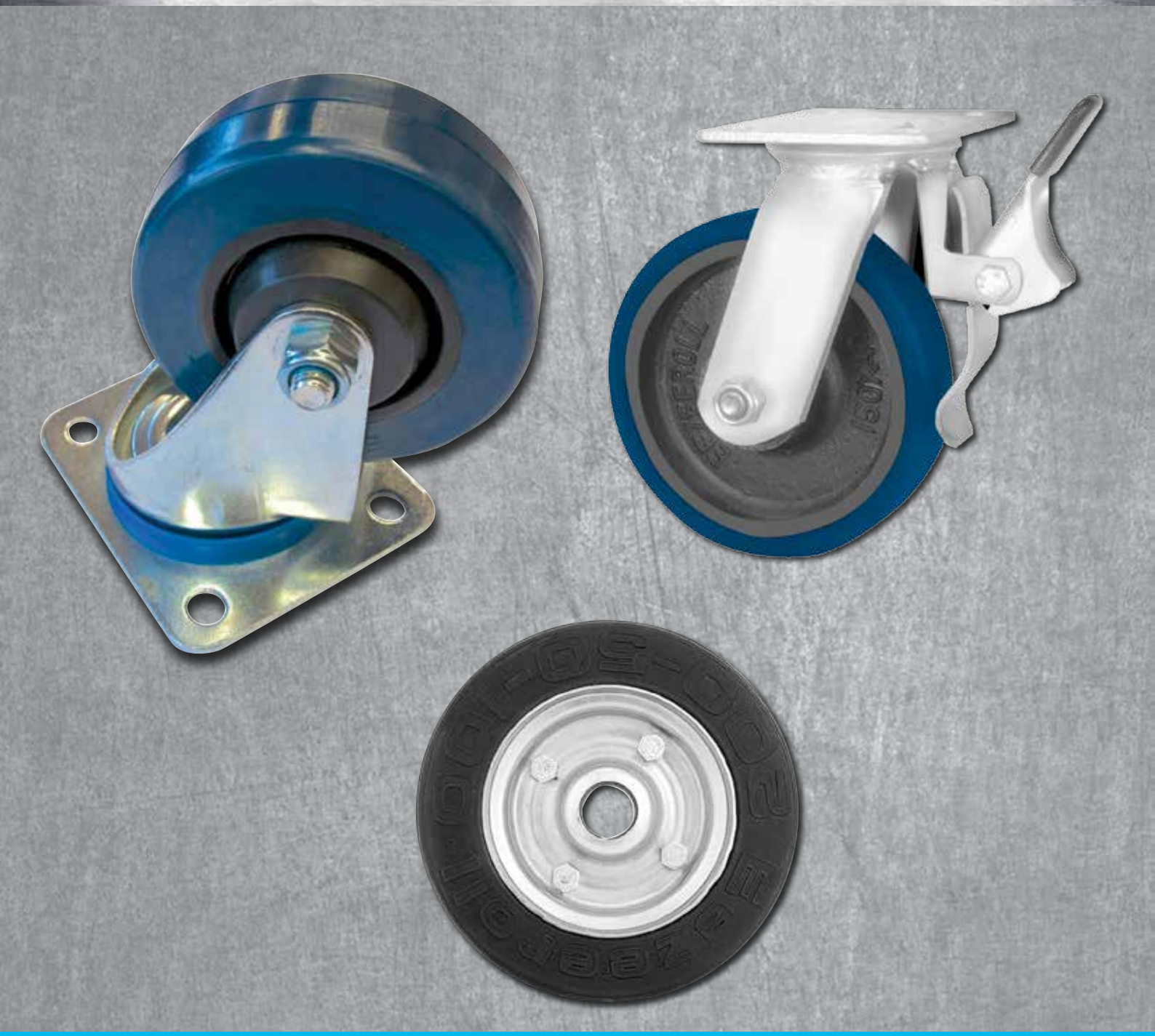


S A LADDER®

CASTORS & WHEELS

EEZEEROLL® wheels & castors with a lifetime bond guarantee

EEZEELASTIC® the wheel with the blue trim

EEZEETHANE® the wheel with the blue trim

PNU SERIES

WPNU 164P25

LOADING kg 100-200

AVAILABLE IN BALL BEARING

S A LADDER®

WPNU-PNEUMATIC SERIES

260	25	70	65	150	WPNU 103P25
400	25	90	75	200	WPNU 164P25

FEATURES

- Inflated tyre and tube
- Nylon or steel centre
- Available in plain bore or ball bearing

For ball bearing add B eg. WPNU1030B25
•Available in 2,4 and 6 ply tyres

STEEL SPLIT DISC RANGE - SOLID RUBBER

WSS SERIES

WSS 200P25

LOADING kg 140-200

AVAILABLE IN BALL BEARING

S A LADDER®

WSS-STEEL SPLIT CENTRE SERIES

150	25	50	60	140	WSS 150P25	WSS 150B25
200	25	50	60	140	WSS 200P25	WSS 200B25
250	25	50	60	150	WSS 250P25	WSS 250B25
300	25	50	60	150	WSS 300P25	WSS 300B25
350	25	75	90	180	WSS 350P25	WSS 350B25
350	25	100	90	180	WSS 350/4P25	WSS 350/4B25
400	25	100	90	200	WSS 400P25	WSS 400B25

FEATURES

- Rubber tyred wheels
- Split steel centre
- Available in plain bore or ball bearing
- Split disc wheels, steel centre, rubber tyre, nylon bush
- Centres are galvanized or powder coated

For ball bearing add B eg. WSS150B25

WSN SERIES

LOADING kg 140

WSN 200

S A LADDER®

AVAILABLE IN ANY COLOUR - MIN QUANTITIES REQUIRED

WSN-NYLON SPLIT CENTRE SERIES

150	25	50	60	140	WSN 150
200	25	50	60	140	WSN 200

PLAIN BORE ONLY

FEATURES

- Rubber tyred wheels
- Split nylon centre
- Available in plain bore

RUBBER TYRED PI SERIES

PI SERIES

PI LOADING kg 80-120

PIB 125

PIP 75

S A LADDER®

PI-GREY RUBBER TYRED SERIES

50	8	19	24	60	PIP 50P	-
75	8	22	30	70	PIP 75P	-
100	12.5	32	40	100	PIP 100	PIB 100
125	12	32	40	120	PIP 125	PIB 125

FEATURES

- Grey rubber tyre bonded to nylon centre
- Available in plain bore or ball bearing
- Economical and hard wearing
- Guaranteed tyre bond to centre

Available in plain bore or ball bearing

S A LADDER® EEZEELASTIC® the wheel with the blue trim

WPN SERIES

PNB200B25

AVAILABLE IN ANY COLOUR - MIN QUANTITIES REQUIRED

PN-POLYURETHANE ON NYLON CENTRE

100	14	32	48	100	PNB100	PNP100
125	14	32	48	150	PNB125	PNP125
160	25	45	60	200	PNB160B25	PNP160
200	25	45	60	300	PNB200B25	PNP200
250	25	45	60	300	-	PNP250

FEATURES

POLYURETHANE TYRE BONDED TO NYLON CENTRE(WPN)

- Guaranteed tyre bond to centre
- Injected polyurethane tyre
- Excellent resistance to corrosion and abrasion
- Available in ball bearing or plain bore

For ball bearing add B eg. WPNB100B

POLYPROPYLENE / NYLON WHEELS

NY SERIES

WED 5P

WED 3P

WNY 8B20

WED-POLYPROPYLENE

50	6	18	24	60	WED 2P
65	8	22	36	90	WED 2.5P
75	12	25	38	110	WED 3P
100	14	30	48	200	WED 4P
125	14	30	48	300	WED 5P
150	20	38	60	400	WED 6P
200	20	45	60	500	WED 8P

PALLET TRUCK ROLLER

85	20	75	75	300	WNY85-75B 20
85	20	100	100	300	WNY85-100B 20

For ball bearing add B eg. WNY 8B

FEATURES

- Virgin nylon 6 material / polypropylene
- Wheels or load rollers
- Excellent running
- Low starting effort on smooth floors
- Hygienic
- High resistance to corrosion and abrasion
- Available in plain bore or ball bearing

WAN SERIES

WAN 4P

HEAT RESISTANT
UP TO 270ºC

75	12	33	41	100	WAN 3P
100	15	38	41	120	WAN 4P
125	15	34	41	150	WAN 5P
150	25	42	56	200	WAN 6P
200	25	42	57	300	WAN 8P

FEATURES

- Phenolic resin wheels
- High temperature applications
- Hard wearing
- Alternative to cast iron in bakeries and general food industries
- Load rating of wheel decreases as temperature increases

SUPER CUSHION RUBBER TYRED WHEELS

SC SERIES

SC160B20

SC-SUPER CUSHION SERIES

160	20	50	60	250	SC160B20
200	20	50	60	300	SC820B20
200	20	75	90	400	SC830B20
250	20	50	60	500	SC1020B20
250	20	75	90	500	SC1030B20
300	20	50	60	600	SC1220B20
300	25	75	90	600	SC1230B25
300	25	100	130	600	SC1240B25
350	25	75	90	700	SC1430B25
400	25	75	90	800	SC1630B25
400	25	100	130	800	SC1640B25

FEATURES

SUPER CUSHION BLACK RUBBER TYRE
BONDED TO CAST IRON CENTRE

- Ideal for towing applications
- Guaranteed tyre bond to centre
- Super cushion rubber tyre
- Excellent resistance to abrasion and shocks
- Available in plain bore or ball bearing

These wheels are standard with ball bearings
Load ratings vary according to speed in towing applications

WRT SERIES

WRT1030B25

S A LADDER®

HEAVY DUTY-BONDED RUBBER WHEELS

100	12	30	45	135	WRT412B12
100	20	38	60	150	WRT415B20
125	20	38	60	200	WRT515B20
150	20	38	60	300	WRT615B20
150	25	50	90	350	WRT620B25
200	20	50	60	400	WRT820B20
250	25	50	60	400	WRT1020B25
250	25	75	60	400	WRT1030B25
250	25	50	60	400	WRT1220B25
250	25	100	60	400	WRT1240B25
250	25	50	60	400	WRT1420B25
250	25	75	60	400	WRT1430B25
250	25	75	60	400	WRT1630B25
250	25	100	60	400	WRT1640B25

Available in plain bore, ball bearing
For plain bore add P eg. WRT412P
For ball bearing add B eg. WRT412B

FEATURES

- Rubber tyre bonded to cast iron centre
- Ideal for towing applications
- Guaranteed tyre bond to centre
- Excellent resistance to abrasion and shocks
- Available in plain bore or ball bearing

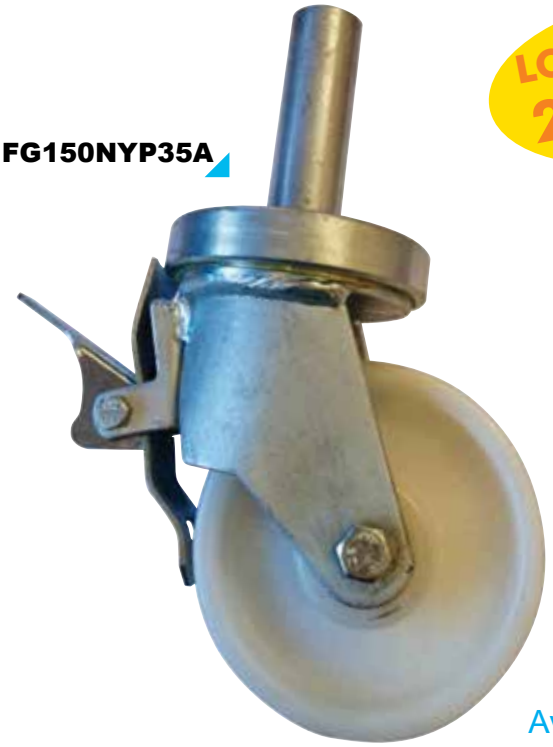
S A LADDER® EEZEELASTIC® the wheel with the blue trim

SCAFFOLD CASTORS

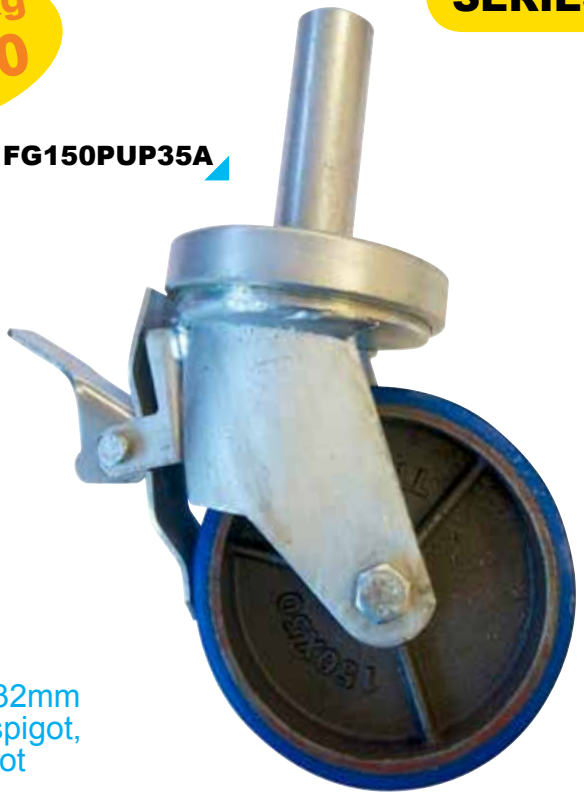
FG SERIES

LOADING kg 200-400

FG150NYP35A



FG150PUP35A



Available with 32mm spigot, 35mm spigot, 38mm spigot

S A LADDER®

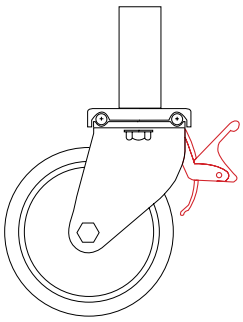
FG SERIES SCAFFOLDING CASTORS

100	200	FG100PUP32A	32
150	400	FG150PUP35A	35/38
200	400	FG200PUP35A	35/38

For foot brake add BK to code after wheel code.
These castors are standard with polyurethane wheels
Other wheels recommended
NY- Nylon, PN- polyurethane on nylon,
PU - polyurethane on cast iron, WED-polypropylene,
CI-cast iron

- Please note: Spigot length 150mm
- Please specify spigot or socket diameter when placing order

OPTIONS AVAILABLE



Please confirm bolt hole centres and plate sizes with your nearest branch before drilling or punching holes.

FEATURES

- spigot fitting
- Fabricated steel housing
- Zinc plated
- Heavy duty single swivel bearing
- Available in swivel with thumb screw wheel brake or foot brake

WPU SERIES

WPU1030 B25

LOADING kg 120-2400

WPU415B20

S A LADDER®

AVAILABLE IN BALL BEARING

LIFETIME GUARANTEE ON BONDING

PU-POLYURETHANE WITH CAST IRON CENTRE

75	12	22	38	120	WPU3P
100	14	30	48	250	WPU412
100	14	38	60	250	WPU415
125	14	30	48	250	WPU512
125	20	38	60	300	WPU515
150	20	38	60	500	WPU615
150	20	50	60	600	WPU620
200	20	38	60	800	WPU815
200	20	50	60	1000	WPU820
200	25	70	90	1200	WPU830
250	25	50	60	1000	WPU1020
250	25	75	90	1500	WPU1030
300	25	50	60	1500	WPU1220
300	25	75	90	2000	WPU1230
300	25	100	120	2200	WPU1240
350	25	50	60	1500	WPU1420
350	25	75	90	2000	WPU1430
400	25	75	90	2000	WPU1630
400	25	100	120	2400	WPU1640

FEATURES

POLYURETHANE TYRE BONDED TO CAST IRON CENTRE (PU)

- Guaranteed tyre bond to centre
- Cast polyurethane tyre
- Excellent resistance to corrosion and abrasion
- Available in ball bearing or plain bore
- Wheels can be specially manufactured to take load of up to 40%more

S A LADDER® EEZEETHANE® the wheel with the blue trim

POLYURETHANE TO STEEL ROLLERS

PU SERIES

ROLLER LOADING kg 500

WPU85-100 B20

S A LADDER®

LIFETIME GUARANTEE ON BONDING

PALLET TRUCK ROLLERS

85	20	82	83	500	WPU85-75B20
85	20	100	100	500	WPU85-100B20

FEATURES

POLYURETHANE TYRE BONDED TO CAST IRON CENTRE (PU)

- Guaranteed tyre bond to centre
- Cast polyurethane tyre
- Excellent resistance to corrosion and abrasion
- Available in ball bearing only
- Wheels can be specially manufactured to take loads of up to 40%more

S A LADDER® EEZEETHANE® the wheel with the blue trim

WCI SERIES

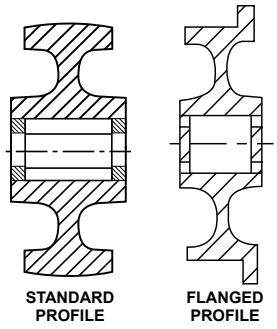
CI LOADING kg 120-2500

V-GROOVE LOADING kg 250-500

S A LADDER®

WCIF200B25

WCI415P14



AVAILABLE IN BALL BEARING

CI-CAST IRON SERIES

75	12	22	38	120	WCI3P
100	14	30	48	250	WCI412
100	14	38	60	250	WCI415
125	14	30	48	250	WCI512
125	20	38	60	300	WCI515
150	20	38	60	500	WCI615
150	20	50	60	500	WCI620
200	20	50	60	900	WCI820
200	25	65	90	1200	WCI830
250	25	50	60	1000	WCI1020
250	25	75	90	1500	WCI1030
300	25	50	60	1500	WCI1220
300	25	75	90	2000	WCI1230
350	25	50	60	1500	WCI1420
350	25	75	90	2500	WCI1430
400	25	75	90	2500	WCI1630

V-GROOVE AND FLANGE CAST IRON WHEELS

					V-GROOVED	FLANGED
100	20	50	60	500	WCIV100	
150	20	50	60	500	WCIV150	WCIF150
200	20	50	60	500	WCIV200	WCIF200

FEATURES

CAST IRON

- Low starting effort on smooth hard surfaces
- Available in plain bore or ball bearing

Cast iron v-grooved and flanged wheels are available in sizes up to 200mm diameter. Wheel specifications available from your nearest branch.

Add BB for ball bearing

LAWN MOWER & HOBBY WHEELS

SR SERIES

SR0602

SR0601

LOADING kg 20-50

LAWN MOWER & HOBBY WHEELS

150	12	35	45	20	SR0601
175	12	35	45	40	SR0701
200	12	40	45	50	SR0801

For semi-prec ball bearing add SPB eg. SR0602

FEATURES

BLACK RUBBER TYRE ON PRESSED STEEL CENTRE

- Light duty
- Pressed steel centre
- Rubber tyre
- Available with semi-precision bearing

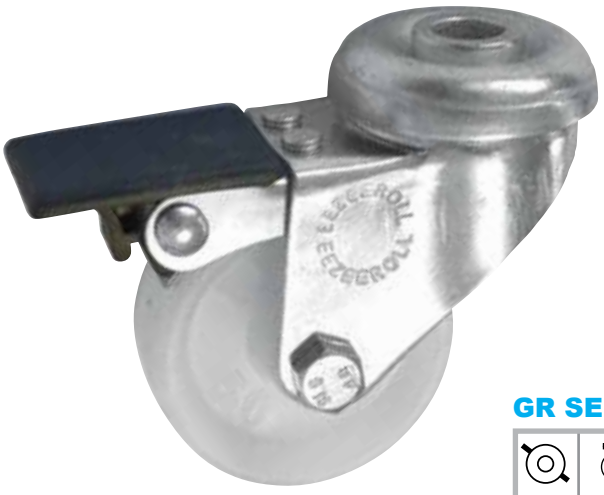
EEZEETHANE the wheel with the blue trim

GR/GN SERIES

LOADING kg 60-70

GR70PBK

GN50HBK



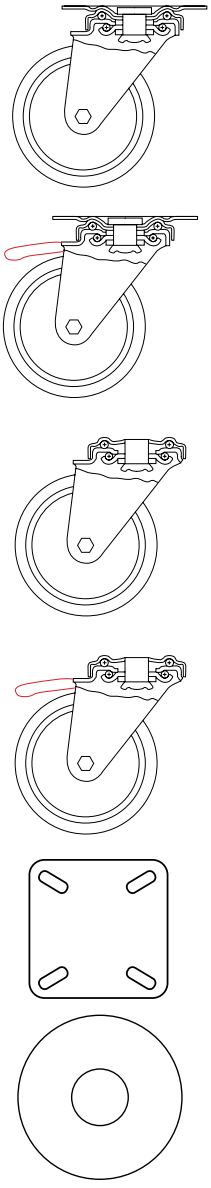
GR SERIES - PLATE FITTING

50	70	50x50	60	GR50P	GR50PBRK
75	105	50x50	70	GR75P	GR75PBRK

GN SERIES - SINGLE BOLT HOLE

50	70	10	60	GN50H	GN50HBRK
75	105	10	70	GN75H	GN75HBRK

OPTIONS AVAILABLE

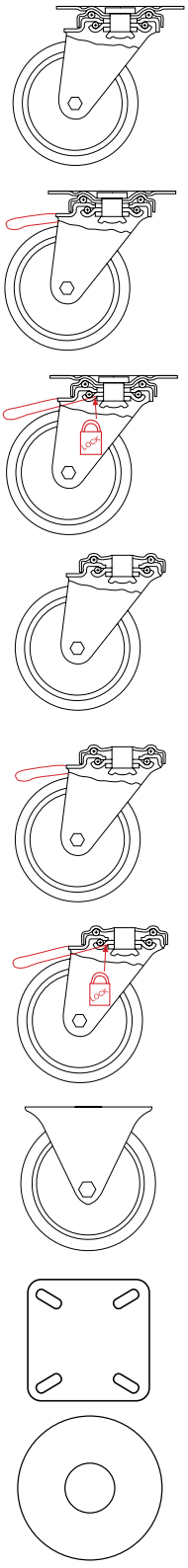


Please confirm bolt hole centres and plate sizes with your nearest branch before drilling or punching holes.

FEATURES

- Bolt hole or plate fitting
- Wheel - grey non-marking or nylon
- Pressed steel housing
- Zinc plated
- Double swivel bearing
- Available in swivel or swivel/brake combination

OPTIONS AVAILABLE



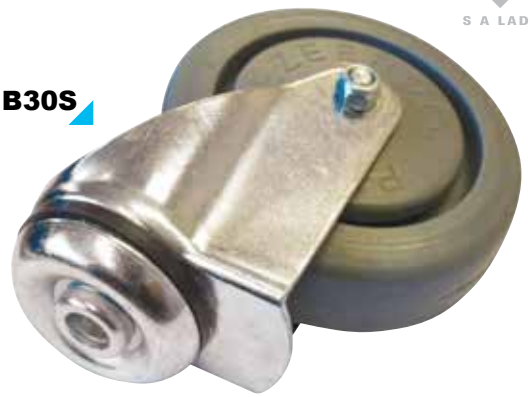
Please confirm bolt hole centres and plate sizes with your nearest branch before drilling or punching holes.

LOADING kg 130-200

11/19 SERIES

411PIB60S

411PIB30S



11 SERIES - PLATE FITTING

100	128	80x90	130	411PIB60S	419PIB	411PIB60BRK
125	155	80x90	150	511PIB60S	519PIB	511PIB60BRK

These castors are standard with grey rubber tyred wheels (PIB)
Other wheels recommended
NY-Nylon, PN-Polyurethane on nylon

11 SERIES - BOLT FITTING

100	124	12	130	411PIB30S	411PIB30BRK
125	151	12	150	511PIB30S	511PIB30BRK

These castors are standard with grey rubber tyred wheels (PIB)
Other wheels recommended
NY-Nylon, PN-Polyurethane on nylon

FEATURES

- Bolt hole or plate fitting
- Pressed steel housing
- Zinc plated
- Double swivel bearing
- Available in swivel, fixed or brake

61/88 SERIES

461CIP

461WED

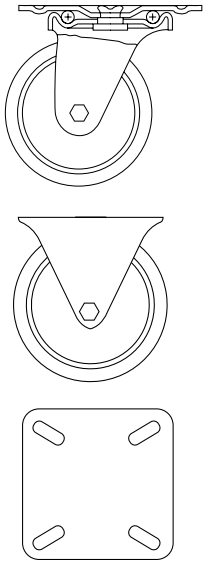
LOADING kg 50-200

61/88 SERIES - PLATE FITTING

50	64	67x48	50	961WED
65	81	95x70	90	261WED
75	95	105x80	100	361WED
100	125	128x102	200	461WED

These castors are standard with polypropylene wheels
Other wheels recommended:
PU- polyurethane on cast iron
PN-Polyurethane on nylon, CI-Cast iron wheels,
AN-Phenolic resin

OPTIONS AVAILABLE



Please confirm bolt hole centres and plate sizes with your nearest branch before drilling or punching holes.

FEATURES

- Plate fitting
- Pressed steel housing
- Zinc plated
- Single swivel bearing

22/29 SERIES

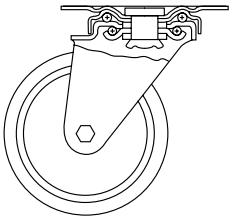
522PUBBRK

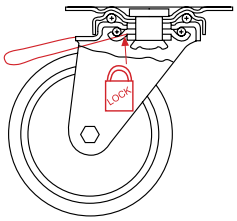
S A LADDER®

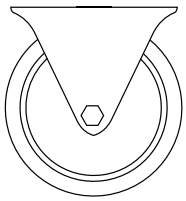
429PUB

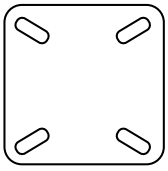
422PNB

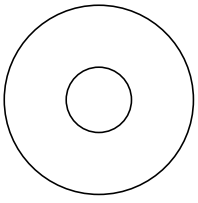
OPTIONS AVAILABLE











Please confirm bolt hole centres and plate sizes with your nearest branch before drilling or punching holes.

22/29 SERIES - PLATE FITTING

100	128	105x85	200	422PNB	429PNB	422PNBBRK
125	155	105x85	200	522PNB	529PNB	522PNBBRK
100	128	135x110	200	422PNBM3	-	-
125	155	135x110	200	522PNBM3	-	-
150	188	135x110	400	622PNB	629PNB	622PNBBRK
200	238	135x110	450	822PNB	829PNB	822PNBBRK

These castors are standard with polyurethane onto nylon (PNB)
Other wheels recommended
NY- nylon, PU- polyurethane on cast iron,
PN- polyurethane on nylon, CI- cast iron wheels, AN- phenolic resin

FEATURES

- Plate fitting
- Pressed steel housing
- Zinc plated
- Double swivel bearing
- Available in swivel, fixed and swivel/brake combination

TL/TR SERIES

TL4CIPBH

TL4PUP

TOP PLATE FITTED WITH 5 HEAVY DUTY RIVETS

LOADING kg 250

TL/TR SERIES WITH PLATE FITTING

75	125	135x110	130	TL3CIP
100	155	135x110	250	TL4CIP
125	178	135x110	250	TL5CIP

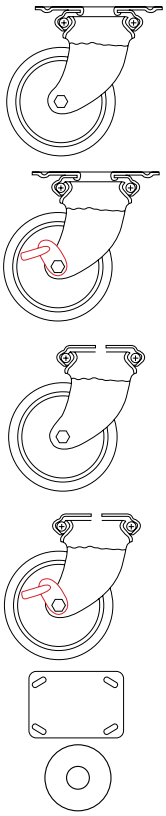
TL SERIES WITH BOLT HOLE FITTING

75	122	10	130	TL3CIPBH
100	152	10	250	TL4CIPBH
125	175	10	250	TL5CIPBH

These castors are standard with cast iron
Other wheels recommended
NY- nylon, PU- polyurethane on cast iron, PN- polyurethane on nylon, CI- cast iron wheels, AN- phenolic resin,

ALSO AVAILABLE WITH SINGLE BOLT HOLE FITTING

OPTIONS AVAILABLE



Please confirm bolt hole centres and plate sizes with your nearest branch before drilling or punching holes.

FEATURES

- Plate fitting
- Pressed steel housing
- Zinc plated
- Single swivel bearing
- Available in swivel or fixed
- Swivel bearing designed to tolerate side thrust

HEAVY DUTY CASTORS

XX/YY SERIES

XX6PUBBRK

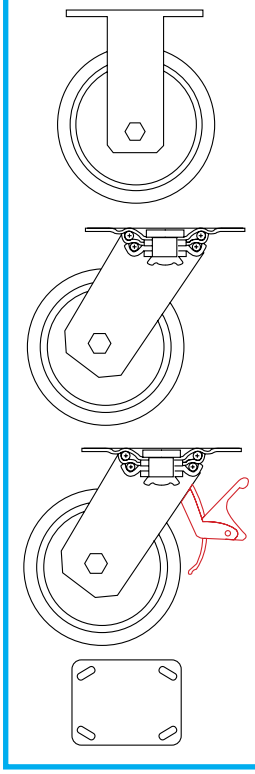
YY8PUB

FOOT BRAKE SHOWN.
COMPETITIVELY
PRICED THUMB BRAKE
ALSO AVAILABLE.

XX8PUB

LOADING kg
400-700

OPTIONS AVAILABLE



Please confirm bolt hole centres and plate sizes with your nearest branch before drilling or punching holes.

XX/YY SERIES - PLATE FITTING

100	140	115x110	400	XX4PUB	YY4PUB	XX4PUBBRK
125	165	115x110	500	XX5PUB	YY5PUB	XX5PUBBRK
150	190	115x110	700	XX6PUB	YY6PUB	XX6PUBBRK
200	241	115x110	700	XX8PUB	YY8PUB	XX8PUBBRK

These castors are standard with polyurethane wheels
Other wheels recommended
PNB-Blue elastic rubber, PN-Polyurethane on nylon, CI-Cast iron wheels, NY-Nylon wheels,

FEATURES

- Plate fitting
- Fabricated steel housing
- Zinc plated
- Double swivel bearing
- Available in swivel, fixed and swivel/brake combination

TH/THR SERIES

LOADING kg 400-1000

FOOT BRAKE SHOWN.
COMPETITIVELY PRICED THUMB BRAKE ALSO AVAILABLE.

TH8PUBBRK
Swivel brake

THR8PUB
Fixed

TH8SCB
Swivel

S A LADDER®

TH/THR SERIES - PLATE FITTING

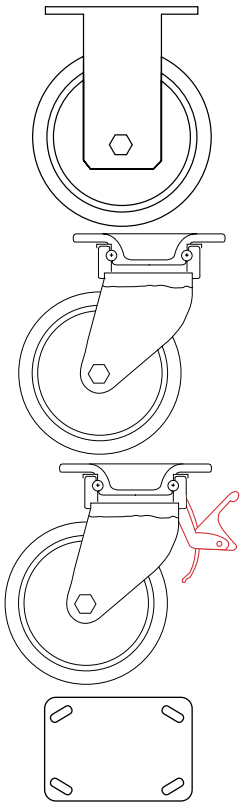
100	150	150x110	400	TH4PUB	THR4PUB	TH4PUBBRK
125	155	150x110	500	TH5PUB	THR5PUB	TH5PUBBRK
150	170	150x110	600	TH6PUB	THR6PUB	TH6PUBBRK
200	250	150x110	900	TH8PUB	THR8PUB	TH8PUBBRK
250	300	150x110	1000	TH10PUB	THR10PUB	TH10PUBBRK
300	350	150x110	1000	TH12PUB	THR12PUB	TH12PUBBRK

To move heavy loads more easily, use our THTW and THRTW twin castor series.
To order twin castors just add TW to the code
These castors are standard with polyurethane wheels
Other wheels recommended
PN-polyurethane on nylon, CI-cast iron wheels,SC- super cushion, PNU-pneumatic

FEATURES

- Plate fitting
- Fabricated steel housing
- Zinc plated
- Heavy duty single swivel bearing
- Available in swivel, fixed or swivel/ brake combination

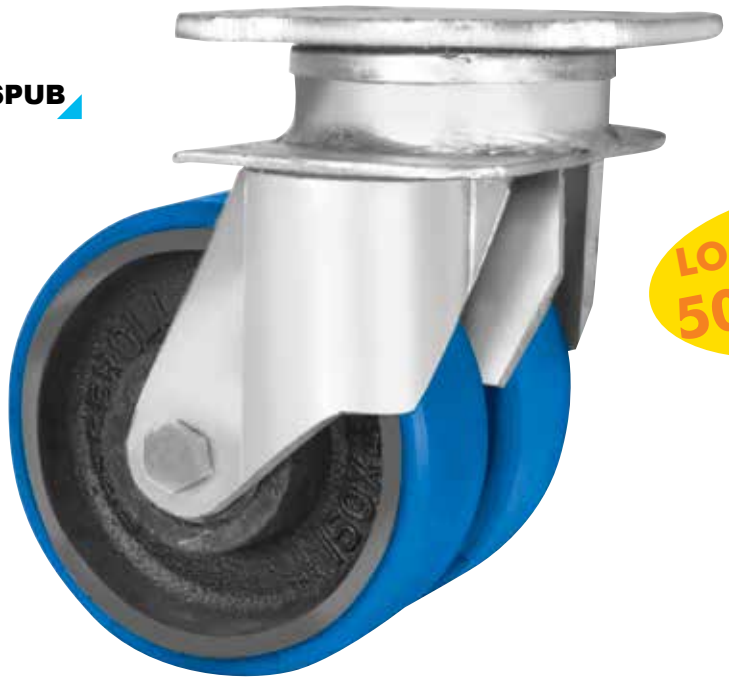
OPTIONS AVAILABLE



Please confirm bolt hole centres and plate sizes with your nearest branch before drilling or punching holes.

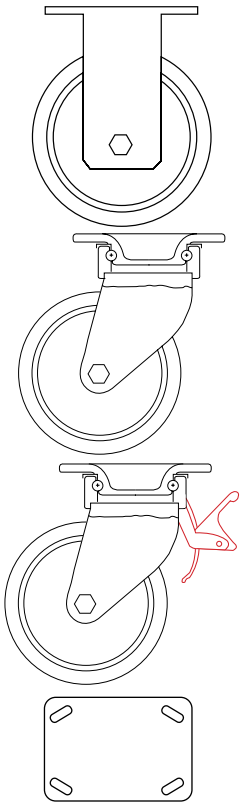
THTW/THRTW
SERIES

THTW6PUB



LOADING kg
500-1000

OPTIONS AVAILABLE



Please confirm bolt hole centres and plate sizes with your nearest branch before drilling or punching holes.

THTW/THRTW SERIES - PLATE FITTING

100	150	150x110	800	THTW4PUB	THRTW4PUB	THTW4PUBBRK
125	175	150X110	1000	THTW5PUB	THRTW5PUB	THTW5PUBBRK
150	200	150X110	1000	THTW6PUB	THRTW6PUB	THTW6PUBBRK
200	250	150X110	1000	THTW8PUB	THRTW8PUB	THTW8PUBBRK
250	300	150X110	1000	THTW10PUB	THRTW10PUB	THTW10PUBBRK
300	350	150X110	1000	THTW12PUB	THRTW12PUB	THTW12PUBBRK

These castors are standard with polyurethane wheels.
Other wheels available
PN-Polyurethane on nylon, CI-Cast iron wheels,
SC- super cushion

FEATURES

- Twin wheel castor
- Plate fitting
- Fabricated steel housing
- Zinc plated
- Heavy duty single swivel bearing
- Available in swivel, fixed or swivel /brake combination

STS SERIES

STS620SCB

LOADING kg 200-1000

FOOT BRAKE AND
DIRECTIONAL LOCK AVAILABLE

STS SERIES TOWING CASTORS

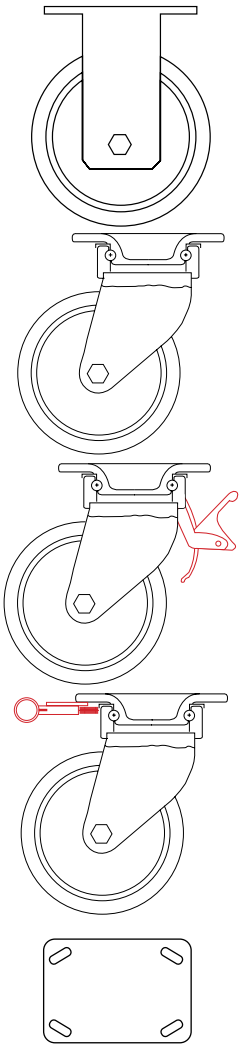
100	38	150	150x110	200	STS415SCB	STF415SCB	STS415SCBBRK
125	38	175	150x110	300	STS515SCB	STF515SCB	STS515SCBBRK
160	50	200	150x110	400	STS620SCB	STF620SCB	STS620SCBBRK
200	50	250	150x110	400	STS820SCB	STF820SCB	STS820SCBBRK
200	75	250	150x110	500	STS830SCB	STF830SCB	STS830SCBBRK
250	50	300	150x110	500	STS1020SCB	STF1020SCB	STS1020SCBBRK
250	75	300	150x110	600	STS1030SCB	STF1030SCB	STS1030SCBBRK

To move heavy loads more easily, use our STSTW and STFTW twin castor series
To order twin castors just add TW to the code
These castors are standard with super cushion wheels
Other wheels recommended
PU- polyurethane bonded to cast iron, RE-Resilex, PNU-Pneumatic

FEATURES

- Plate fitting
- Fabricated steel housing
- Zinc plated
- Combination thrust bearing and tapered roller bearing swivel
- Available in swivel, fixed or swivel/ brake combination

OPTIONS AVAILABLE



Please confirm bolt hole centres and plate sizes with your nearest branch before drilling or punching holes.

EXTRA HEAVY DUTY CASTORS

LT/LTR SERIES

LT12PUB

S A LADDER®

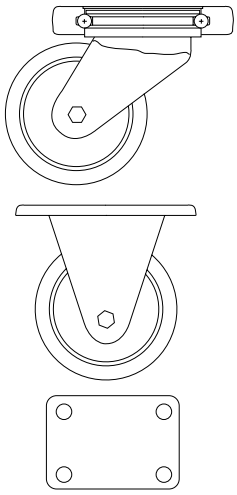
LOADING kg 1200-2500

LT SERIES EXTRA HEAVY DUTY CASTORS

150	205	240x130	1200	LT6PUB	LTR6PUB
200	255	240x130	1500	LT8PUB	LTR8PUB
250	305	240x130	1500	LT10PUB	LTR10PUB
300	355	240x130	2000	LT12PUB	LTR12PUB
350	405	240x130	2500	LT14PUB	LTR14PUB
400	455	240x130	2500	LT16PUB	LTR16PUB

To move heavy loads more easily, use our LTTW and LTRTW twin castor series
To order twin castors just add TW to the code
These castors are standard with polyurethane wheels
Other wheels recommended
CI- Cast iron

OPTIONS AVAILABLE



Please confirm bolt hole centres and plate sizes with your nearest branch before drilling or punching holes.

FEATURES

- Plate fitting
- Fabricated steel housing
- Extra heavy duty single swivel bearing
- Available in swivel and fixed

LTTW/LTRTW
SERIES

TTTW8 PUB

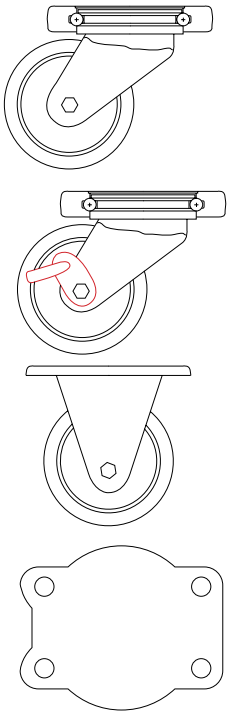
LOADING kg
2400-5000

LT TWIN SERIES

150	205	240x130	2000	LTTW6PUB	LTRTW6PUB
200	255	240x130	2400	LTTW8PUB	LTRTW8PUB
250	305	240x130	3000	LTTW10PUB	LTRTW10PUB
300	355	240x130	4000	LTTW12PUB	LTRTW12PUB
350	405	240x130	5000	LTTW14PUB	LTRTW14PUB
400	455	240x130	5000	LTTW16PUB	LTRTW16PUB

These castors are standard with polyurethane wheels
Other wheels recommended
CI-Cast iron

OPTIONS AVAILABLE



Please confirm bolt hole centres and plate sizes with your nearest branch before drilling or punching holes.

FEATURES

- Plate fitting
- Fabricated steel housing
- Zinc plated
- Combination thrust bearing and tapered roller bearing swivel
- Available in swivel, fixed or swivel/ brake combination

GATE ROLLERS

VG SERIES

LOADING kg 100-120

WVG 60-KIT

S A LADDER®

GATE ROLLER KITS

60	12	40	100	WVG60
80	12	40	120	WVG80

FEATURES

- Each kit contains two fabricated steel v-grooved wheels in brackets and two nylon gate guides
- Wheels utilise precision ball bearings that are easy to replace

1.0 SPECIFICATION FOR STANDARD WHEELS & CASTORS

1. Plain bore tolerances are + 0,57-0,00mm
2. Standard tolerances on width and diameter +- 0,25mm
3. All wheels are fitted with grease nipples, other than keywayed wheels, nylon/nylon centred wheels or wheels of 75mm or 100mm diameter
4. Wheels of 75mm or 100mm diameter fitted with ball journals have pre-lubricated double-shielded bearings
5. All wheels supplied with ball journals, other than those of 75mm or 100mm diameter, have bearings with a single shield fitted to the other side unless otherwise stated.
6. All wheels with ball or roller bearings, other than those fitted with pre-lubricated double shielded ball journals are supplied un-greased to avoid contamination during shipment.
7. All wheels fitted with ball journals have a central spacer between the bearings to allow them to be clamped to an axle abutment shoulder without pre-loading the bearings.
8. Taper roller bearings are supplied with the outer (cup) race press fitted, and the inner cone and roller assembly, together with metal shields, supplied loose.
9. All cast wheels are finished in one coat of self-etching black primer paint.
10. Fully machined wheels or axles from billet or barstock are protected by a coat of air-drying oil.
11. Pressed steel castor brackets are finished in bright zinc electroplating to BS1706.
12. Fabricated castor brackets are finished in one coat of self-etching black primer paint.

2.0 UNTYRED WHEELS

When less than the full tread width is used to carry the load, the allowable load can be determined as follows:-
Allowable load = load carrying width x “Maximum load Rating” (per catalogue) full tread width

3.0 RUBBER TYRED WHEELS

3.1 LOAD RATING

The ‘Maximum Load Rating’ given for each rubber tyred wheel is the maximum load the wheel will carry in constant use under the following conditions:

a) the wheel is free-wheeling (not driving)
b) the ambient temperature is below 30 degrees C
c) the surface speed does not exceed 6kph
d) the surface on which the wheel runs is flat and smooth (i.e steel or smooth concrete)
e) that the wheel is not steering or subjected to axial loads
f) no chemical is present which will attack rubber (see 3.2)

For more severe conditions than those described above refer to SA Ladder for the allowable load, or consider polyurethane tyred wheels.

3.2 RESISTANCE TO CHEMICALS

A - little or no effect

B - moderate effect

C - severe effect .

Acetic Acid	C	Formaldehyde	C	Mineral Oils	C
Acetone	C	Formic acid	B	Naphtha	C
Ammonium hydroxide	C	Fuel oil	C	Naphthalene	C
Barium hydroxide	B	Gasoline	C	Nitric acid	C
Benzene	C	Glue	B	Oil-lubricating	C
Borax	A	Hydraulic oils	C	Palmic acid	C
Boric Acid	A	Hydrochloric acid-cold	A	Perchlorethylene	C
Butane	C	Hydrochloric acid-10%	A	Phenol	C
Calcium Bisulphite	C	Hydrochloric acid-hot	C	Phosphoric acid-85%	A
Calcium chloride	A	Hydrochloric acid-30%	C	Sodium hydroxide	C
Calcium hydroxide	B	Hydrogen	B	Soybean oil	C
Carbon dioxide	A	Isopropyl ether	C	Sulphuric acid 10%	A
Carbon monoxide	C	JP-3	C	Sulphuric acid 50%	C
Carbon tetrachloride	C	JP-4	C	Tannic acid	A
Castor oil	B	Kerosene	C	Toluene	C
Chlorine	C	Linseed oil	C	Trichloroethylene	C
Chromic acid	C	Magnesium chloride	A	Turpentine	C
Cottonseed oil	C	Magnesium hydroxide	A	Water	A
Cyclohexane	C	Methyl alcohol	A	Xylene	C
Ethyl acetate	C	Methyl ethyl ketone	C	Zinc sulphate	A
Ethyl alcohol	A	Mercury	A		

4.0 POLYURETHANE (EEZEETHANE) TYRED WHEELS

4.1 LOAD RATING AND FACTORS

The 'Maximum Load Rating' given for each polyurethane tyred wheel is the maximum load the wheel will carry in intermittent use (a maximum of 1 hour running followed by a minimum of 1 hour at rest) under the following conditions:

a) the wheel is free-wheeling (not driving)
b) the ambient temperature is below 45 degrees C
c) the surface speed does not exceed 6 k.p.h.
d) the surface on which the wheel runs is flat and smooth (i.e. steel or smooth concrete)
e) that the wheel is not steering or subjected to axle load
f) no chemical is present which will attack polyurethane (see 4.2)

For more severe conditions the 'Maximum Load Rating' must be multiplied by the 'load factor' as follows:

Condition	**Load factor**
continuous running	0.75
surface speed 6-10 kph	0.8
surface speed 10-16	0.7
driving wheels	0.7

For speeds over 16 kph, for operating temperatures over 45 degrees C and below 20 degrees C, for humid conditions, and for curved running surfaces (i.e. in supporting rotating drums) refer to SA Ladder for the allowable load.

LOAD factors must cumulate, for example:
a wheel with a 'maximum load rating' of 1000kg is to be subjected to continuous running at 8kph in a driving application,
allowable load = 1000kg x 0.75 (continuous running factor) x 0.8 (speed factor) x 0.7 (driving factor) = 420kg

4.2 RESISTANCE TO CHEMICALS

A - little or no effect

B - moderate effect

C - severe effect .

Acetic Acid 20% max	B	Formic acid	C	Palmic acid	A
Acetone	C	Fuel oil	B	Percthlorethylene	C
Ammonia hydroxide	A	Gasoline	B	Phenol	C
Barium hydroxide	A	Glue	A	Phosphoric acid 70%	A
Benzene	C	Hydraulic oil	B	Phosphoric acid 80%	C
Borax	A	Hydrochloric acid-20%max	B	Potassium hydroxide	B
Boric acid	A	Hydrochloric acid-30%+	C	SAE No. 10 oil(70%)	A
Butane	A	Hydrogen	A	Sea water	A
Calcium bisulphite	A	Isopropyl ether	B	Soap solutions	A
Calcium chloride	A	JP-4	B	Sodium hydroxide-20%max	A
Calcium hydroxide	A	JP-5	C	Sodium hydroxide-45%max	B
Carbon dioxide	A	JP-6	C	Sodium hypochlorite	C
Carbon monoxide	A	Kerosene	B	Soybean oil	B
Carbon Intrachloride	C	Ketone	C	Slearic acid	C
Castor oil	A	Linseed oil	B	Sulphuric acid 10%max	A
Chlorine	C	Magnesium chloride	A	Sulphuric acid 10%+	B
Chromic acid	C	Magnesium hydroxide	A	sulphuric acid 50%	C
Copper chloride	A	Mercury	A	Tannic acid	A
Copper sulphate	A	Methyl alcohol	C	Toluene	C
Cottonseed oil	A	Methyl ethyl	C	Trichlorothylene	C
Cyclohexane	A	Mineral oils	A	Turpentine	C
Ethyl acetate	C	Naptha	B	Water (45%)	A
Ethyl alcohol	C	Napthalene	B	Water (100%)	C
Ethylene glycol	B	Nitric acid	C	Xylene	C
Formaldehyde	C	Oils-lubricating	B		

5.0 CALCULATION OF PRINT AREA FOR SOLID TYRES

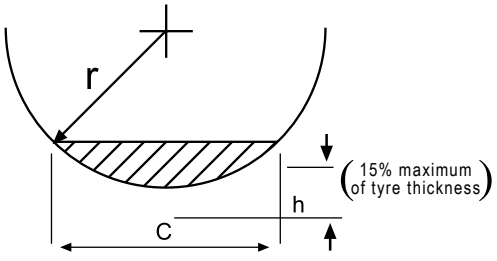
The deflection of solid tyre under load should not exceed 15% of the tyre thickness to prevent premature failure of the tyre due to overload.

$$C = 2\sqrt{h(2r-h)}$$

Area of print = C x tread width (footprint)

where:

C = length of flat produced under load
h = deflection (15% max of tyre thickness)
r = radius of wheel



WHEEL TYPE	TYRE THICKNESS MM	WHEEL TYPE	TYRE THICKNESS MM	WHEEL TYPE	TYRE THICKNESS MM
R75/36, R75/35	12.5	H200/75	20	PH250/75,PH250/125	20
H85/75	12.5	R250/45,R250/70,H250/45,H250/70	12.5	PH300/75	20
R100/40, H100/40, H100/100	12.5	H250/97.5	25	PH300/75,PH380/100,PH380/125	37.5
R125/30, R125/45, H125/30, H125/45	12.5	R300/50,R300/75,H300/5, H300/75,	25	PH460/75,PH400/100	42.5
H150/35, R160/50, H150/35, H150/50	12.5	H350/100	25	PH500/75,PH500/100	37.5
H150/160	25	H400/100,H400/125	30		
R200/40, R200/60, H200/40, H200/60	12.5	H460/75	35		

6.0 RAIL WHEELS

6.1 APPROXIMATION OF ALLOWABLE LOAD FOR CATALOGUE ITEMS

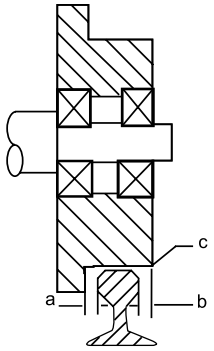
The 'maximum load rating' given for each rail wheel (types CSF, SSF, CDF, CFT and SFT) is the maximum load the wheel can carry without permanent deformation and to give an acceptable service life when the full tread width is in contact with the rail.

In practice full contact with the rail across the tread width is rarely achieved due to

a) flange to rail clearance

b) wheel coverage

c) rail corner radi



Allowable load capacities of catalogue items used on given rail can be determined as follows:

$$\text{Allowable Load} = \frac{\text{useable Rail width (per 6.2.3)}}{\text{full tread width (per catalogue)}} \times \text{maximum load rating (per catalogue)}$$

NOTE:

1) the 'useable rail width' (per para 6.2.3) takes into account the profile of the rail head, whether convex or flat.
2) the above applies to wheels with very light axial (flange) loads when fitted with bearings. Heavy axial loads will severely limit the radial load carrying capacity of the bearings - see 7.1
3) ' Maximum Load Ratings ' of catalogue items are based on PL = 0.56, C1 = 1.1 C2 = 0.9 for steel wheels and PL = 0.15 C2 = 0.8 for cast iron wheels - refer to 6.2 & 6.3 for relevant equations.

6.0 RAIL WHEELS

The following equations can be used for wheels of up to 1.25 diameter of cast, rolled or forged steel, or S.G cast iron, to determine the relationship between:

1) wheel diameter
2) ultimate strength of wheel material
3) load capacity
4) service life
5) the useable width of the rail
6) speed rotation of the wheel

a) for the wheel to with stand the maximum static load to which it is subjected:

$$PL2 \quad \frac{Ps\ mean}{b \times D \times C1\ max \times C2\ max} = \frac{Ps\ mean}{bx\ Dx\ 1{,}38}$$

and

b) For the wheel to perform its specified duty without abnormal wear:

$$PL2 \geq \frac{Pd\ mean}{b \times D \times C1 \times C2}$$

Where

D = wheel diameter (mm)
b = useable rail width (mm) - see 6.2.4
PL = limiting pressure (kgf/mm2) - see 6.2.1
C1 = a coefficent determined by r.p.m. - see 6.2.2
C1max = 1.2
C2 = a coefficent determined by ' machine life and utilisation ' - see 6.2.3
C2 max = 1.15
Ps mean = the mean static load to be withstood by the wheel (kg)

$$= \frac{2P2\ max + P2\ min}{3}$$

Pd mean = the mean dynamic load to be withstood by the wheel (kg)

$$= \frac{2\ Pd\ max + Pd\ min}{3}$$

6.2.1 Determining the limited pressure PL
(as a function of the ultimate strength of the metal of which the rail wheels made)

Notes:

1) In the case of wheels heat treated to increase the surface hardness, the value of PL is limited to that of the steel prior to surface treatment

2) The "limiting pressure" PL is a rational pressure determined by supposing that the contact between wheel and rail takes place over a surface whose length is a diameter of the wheel, and width is the "useable rail width" b.

6.2.2 Determining coefficiant C2

Determine coefficient C2
(machine life and utilisation)

Should a longer service life be required for a given material whose load/life properties have been determined per paragraph 6.2 refer to paragraph 6.4 'Surface Hardening'.

Wheel rotational speed R.P.M.	C1	Wheel rotational speed R.P.M.	C1	Wheel rotational speed R.P.M.	C1
5.0	1.17	20.0	1.06	63	0.91
5.0	1.16	22.4	1.04	71	0.89
0.3	1.15	25.0	1.03	80	0.87
8.0	1.14	28.0	1.02	90	0.84
10.0	1.13	31.5	1.00	100	0.82
11.2	1.12	35.5	0.99	112	0.79
12.5	1.11	40.0	0.97	125	0.77
14.0	1.10	45.0	0.96	160	0.72
16.0	1.09	50.0	0.94	200	0.66
18.0	1.07	56.0	0.92		

Utilisation	Service Life - Hours							
	400	800	1600	3200	6300	12000	25000	5000
Mechanisms subjected very rarely to their maximum load and,normally, to very high loads	1.12	1.12	1.12	1.12	1.12	1.00	0.90	0.80
Mechanisms occasionally subjected to their maximum load, but, normally to rather lighter loads	1.12	1.12	1.12	1.12	1.00	0.90	0.80	0.80
Mechanisms frequently subjected to their maximum load and, normally to loads of medium magnitude	1.12	1.12	1.12	1.00	0.90	0.80	0.80	0.80
Mechanisms frequently or constantly subjected to their maximum load	1.12	1.12	1.00	0.90	0.80	0.80	0.80	0.80

6.2.3 Determining the useable rail width, b
The useable rail is determined by the following equations:

1) for convex topped rails b(mm)=C- 4/3 r
(these are generally flat bottomrails)

2) for flat topped rails b(mm) = C - 2r
(these are generally bridge, crane and barstock rails)

6.3 CALCULATION OF ALLOWABLE LOAD - CAST IRON RAIL WHEELS

While grey cast iron wheel are the most economic for light to medium duty, they are not suitable for high rotational speeds or where substantial shock loadings are to be withstood . Their performance is not as predictable as that of steel or S.G.iron wheels due principally to the presence of flake graphite which encourages 'spalling' of the surface.

6.3.1. Allowable Load - grey iron as cast

The relationship between Where:
D = wheel diameter (mm)
b = useable rail width (mm) see 6.2.3

1) wheel diameter
2) load capacity PL= 0.15 (a conservative value to provide an acceptable service life)
3) usable rail width C2 max =0.8

but not service life, can be approximated by the equation $PL = \frac{P\,max}{b \times D \times C2\,max}$ P max = max load to be withstood by the wheel(kg)

6.3.2. Allowable load - chilled cast iron or surface hardened cast iron. Chilling or surface hardening of cast iron refines and hardens the surface to give an economic wheel capable of carrying moderate loads with a service life similar to that of comparable steel wheels. For cast iron wheels having a hardened surface, the equation for steel wheels applies (para 6.2) with a value PL = 0,50

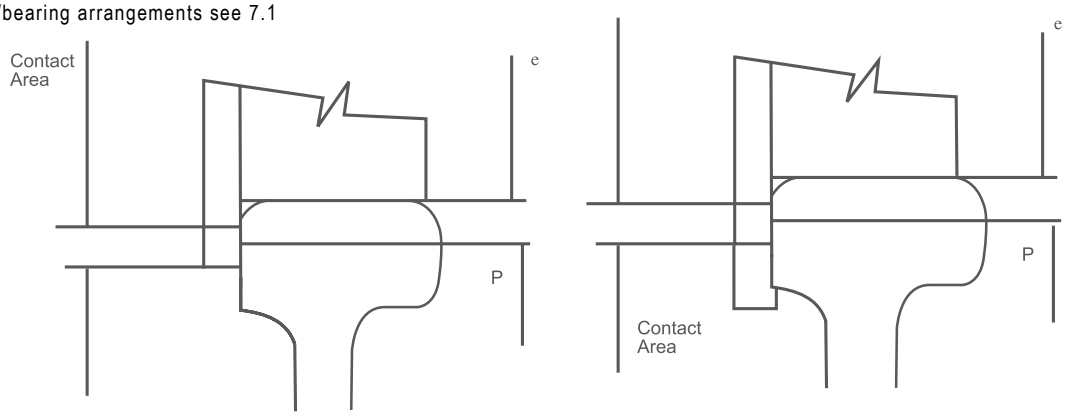
6.4 SURFACE HARDENING

Surface hardening can extend service life beyond that given in para 6.2.3. a guide to the relationship between surface hardness and service life being:

Surface Hardness (Hv)	Life Factor (240Hv=1)
240	1.0
380	1.7
320	2.0
360	2.2
400	2.3

Where : Otu= tensile strength of the wheel material (N/mm2)
tf = Flange thickness (mm)
N = Flange Saftey factor (2.0 min recommendation)
Km = load factor •1.0 for gradually applied loads
•1.5 for suddenly applied loads
Kc = casting factor (for cast wheels only) 1.5
0 = dimension (mm) from tread to point of application of load P as shown:

Note: Moments about bearings and axle loads on bearings due to flange loads must be taken into account when selecting bearings and axle/bearing arrangements see 7.1



7.0 BEARING AND SEAL ARRANGEMENTS - NON STANDARD WHEELS

7.1 Selection Of Bearings
The main considerations in the selection of bearings are:
1. radial load
2. axle load
3. speed of rotation
4. bearing friction

In selecting ball or roller bearings it is important that the static and/or dynamic radial load rating requirement for each bearing should be determined taking into account a) the radial load b) the radial equivalent or any axle load (as given in the bearing manufacturer's catalogue), and c) the radial load resulting from the moment of the axle load acting about the bearings. It should be noted that in most bearing arrangements axle loads are taken by only one bearing, and that loads caused by condition c) above usually act positively on one bearing (being added to the radial load) and negatively on the other bearing (being deducted from the radial load)

DESCRIPTION	GENERAL ARRANGEMENT	RADIAL LOAD	AXIAL LOAD	SPEED OF ROTATION	BEARING FRICTION
1. Plain bronze or self-lubricating bushing		Very high	Very light	Low	Moderate / High
2. Flanged bronze or self-lubricating bushing		Very high	High	Low	Moderate / High
3. Ball bearings		Light / Moderate	Light	High	Low
4. Opposed taper roller bearings		Moderate	Moderate	High	Low
5. Special roller bearings		High	Light / Moderate	High	Low
6. Special roller or cylindrical roller bearings and thrust washers or thrust bearings		High	Very high	High	Low
7. Needle roller bearings and thrust washers or thrust bearings		Very high	Very high	High	Low

7.2 BEARING SEALS

Bearing seals perform two main functions

1) To prevent the ingress of material which will affect the life of performance of the bearing.

   and/or

2) To retain lubricant particularly in hot or hostile environment.
   Some typical sealing arrangements are illustrated:

DESCRIPTION	GENERAL ARRANGEMENT	APPLICATION NOTES
1. Bearings with seals and/or metal shields		Seals can be on one (outer) side only for lubrication via a grease nipple, or sealed bolt sides in "sealed for life" applications. Seals of this type are not generally available for roller bearings.
2. Metal external shields		The simplest way of shielding roller or taper roller bearings, but without providing a complete seal.
3. Spring loaded lip seals		Provides excellent sealing. Spring should face outwards for grease renewal via a nipple and to prevent ingress of material, and inwards to retain lubricant in "sealed for life" applications. Normal temperature range -10ºC to +100ºC.
4. Felt seals		Useful in high temperature applications in conjunction with suitable lubricants. Provide effective sealing of split housing.
5. "O" ring seals		Can provide complete sealing, particularly against external pressure such as underwater applications. Suitable only for circumferential surface speeds of less than 30m/min and temperatures of 40`C - 110`C.
6. Pressed steel labyrinth		Suitable only for "sealed for life" applications as re-greasing via a nipple tends to force the labyrinth out of its housing. Extra sealing can be obtained by inserting greased felt washers within the labyrinth during assembly.
7. Machined labyrinth		Can be useful in conjunction with spring-loaded lip seals to provide the most effective seal in hostile environments

8.0 ROLLING FRICTION

The main forces resisting initial movement and acceleration of a wheeled vehicle are:

1) The rolling friction between the wheel and the surface on which it rests and, in the case of tyred wheels the rolling resistance of the flat area of tread caused by static loading.

2) The friction within the wheel or axle bearings

3) The inertial resistance of the vehicle and load.
The main forces resisting the maintenance of movement after acceleration from rest are 1) and 2) above (excluding the effect of a tyre “flat”)

8.1 ROLLING FRICTION

8.1.1. Polyurethane tyred wheel:
Guide figures for rolling resistance per wheel as a percentage of load per wheel
1) from rest , when the period of rest is 8 hours maximum= 5% of load
2) from rest, when the period of rest is greater than 8 hours =8% of load
3) to maintain a constant speed = 3% of load

Note: these figures are approximations as they are influenced by such factors as ambient temperatures, the track surface, the load/rest cycle timing, wheel diameter etc.

8.1.2 Rail wheels
When a body rolls on a surface, the forces resisting the motion is termed rolling friction. The force required to overcome rolling friction of a rail wheeling constant motion is determined by the equation F= • xP Where:

F = Force required to overcome rolling friction (kgf) per wheel
λ = Lambda, the coefficient of rolling friction
P = Load per wheel (kg)

8.1.2.1 Determining the coeficient of rolling friction λ
The contact pressure (Hertz) between wheel and rail being determined by the equation

$$Pa = \frac{2xP}{\pi \times B \times b}$$

Where:
Pa = Contact pressure (Hertz) in Kgl/mm2
P = Load on Wheel (kg)
b = Useable rail width (mm) - see 6.2.4
a = half the width of thin ‘plane contact zone’ between wheel and rail

(Contact Pressure 9hertz) between Wheel and Rail (kgf/mm2)	Coefficiant or Rolling Friction
30	0.005
40	0.007
50	0.008
60	0.010
70	0.012
80	0.013

$$a=\sqrt{\frac{4xPxR}{\sim xPxb}}$$

Where:
P = Load on wheel (kg)
R = Radius of wheel (mm)
b = Useable rail width (mm)
8 = Effective Youngs Modulus of plasticity
= 7470 Kg/mm2 for an iron wheel on a steel rail
= 11200 kg/mm2 for a steel wheel on a steel rail

8.2 BEARING FRICTION

For the purpose of determining the force required to start or maintain a wheel in motion the frictional resistance of ball or roller bearings, with the coefficient in the region of 0.002, can be disregarded.

The force required to overcome bearing friction for plain bearings is determined by the equation $F = \frac{\mu x P x d}{D}$

Where: F = force required to overcome bearing friction (kg)
μ = the coefficient of friction
P = load on wheel (kg)
d = diameter of axle (mm)
D = diameter of wheel (mm)

The table gives guide figures for the coefficient of friction p for roller bearings and for various plain bearing materials running on a smooth steel axle.

BEARING MATERIAL	COEFFICIANT OR FRICTION μ	
	LUBRICATED	UNLUBRICATED
Cast iron	0.21	0.40
Bronze	0.16	0.35
Thin wall PTFE/Load wrapped brushes	0.02 - 0.20	0.02 - 0.20

The lubricated coefficient should be used for wheels in motion, and the unlubricated coefficient for wheels starting from a period of rest under static load (which assumes the worst condition.)

8.3 INERTIAL RESISTANCE

To calculate the force required to accelerate the mass of the vehicle and its load from rest with a uniform rate of acceleration on a level track.

1) When the time taken to achieve the final velocity is known $F = \frac{MxV1}{t \times g}$

2) when the distance taken to achieve the final velocity is known $F = \frac{MxV1}{2 \times s \times g}$

Where: F = force required to overcome inertia (kg)
M = total mass of vehicle and load (kg)
V1 = final velocity (m/sec)
t = time taken to achieve final velocity from rest (secs)
s = distance taken to achieve final velocity from rest (m)
g = force of gravity = 9.81m/sec2

9.0 TRACTION - COEFFICIENT OF FRICTION

The traction of a driving wheel = μxP

Where μ= the coefficient of friction for a given wheel material and track surface.

P= the load of the wheel

Guides values for coefficients of friction p, for wheel and tyre materials in contact with various surfaces are given:

BEARING MATERIAL	WHEEL OR TYRE MATERIAL				
	RUBBER	POLYURETHANE	STEEL	CAST IRON	NYLON
Dry steel	0.8	0.7	0.6	0.4	0.4
Wet steel	0.5	0.4	0.4	0.3	0.15
Dry smooth concrete	0.8	0.7	-	-	-
Wet smooth concrete	0.5	0.6	-	-	-
Dry rough concrete	1.0	0.8	-	-	-
Wet rough concrete	0.9	0.6	-	-	-
Ice	0.1	0.1	0.02	0.02	-

10.0 LOAD CALCULATIONS FOR WHEELS SUPPORTING AND/OR DRIVING ROTATING DRUMS

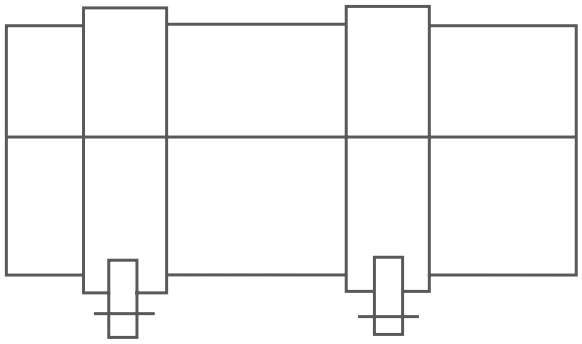
In installations where support wheels drive the drum we recommend that the driving wheels be positioned on the upwardly rotating side of the drum (as shown bellow) which is the more heavily laden side.

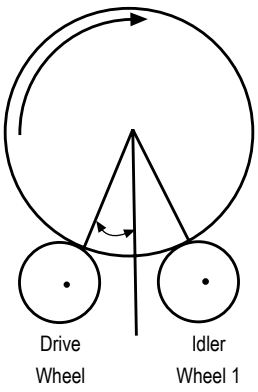
To determine the required "Maximum Load Rating" for wheels at each support position for the purpose of wheel selection:

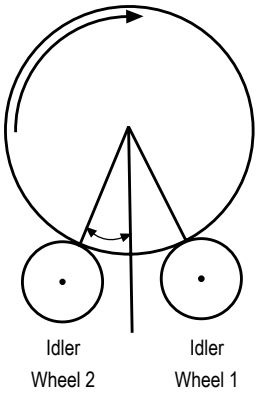
Maximum Load Rating - Drive Wheel $= \dfrac{(0.5P1) + P2}{\text{Cos} \quad xLxLg}$

Maximum Load Rating -Idler Wheel 1 $= \dfrac{0.5(P1+P2)}{\text{Cos} \quad Lg}$

Maximum Load Rating -Idler Wheel 2 $= \dfrac{(0.5P1)+ P2}{\text{Cos} \quad x\ Lg}$







Where: P1 = weight of the drum at the support position under consideration (kg)

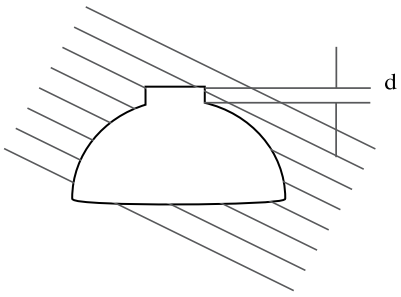
P2 = weight of the contents at the support position under consideration (kg)

L = 0.7- load factor for driving wheels (polyurethane tyred wheels only)

Lg= Load factor according to drum surface speed-see4.1 (polyurethane tyred wheels only)

11.0 KEYWAY DIMENSIONS - PARALLEL KEY

(to commercial tolerances - keyways toBS4G: part 1 : 1958 and BS4235: part2: 1972 available to order)



METRIC			
BORE Ø -0.00 +0.05	KEY SECTION		KEYWAY DEPTH
	WIDTH	HEIGHT	'd' - 0.0+0.2
12	4	4	1.8
20	6	6	2.8
25	8	7	3.3
30	8	7	3.3
35	10	8	3.3
40	12	8	3.3
50	14	9	3.8
60	18	11	4.4
75	20	12	4.8
100	28	16	6.4
150	36	20	8.4

INCH			
BORE Ø -0.000 +0.002	KEY SECTION		KEYWAY DEPTH
	WIDTH	HEIGHT	'd' - 0.00+6.006
0.5	0.125	0.125	0.060
0.75	0.188	0.190	0.088
1.00	0.250	0.250	0.115
1.25	0.312	0.250	0.112
1.50	0.375	0.250	0.100
2.00	0.500	0.312	0.131
2.50	0.625	0.438	0.185
3.00	0.750	0.500	0.209
3.50	0.875	0.625	0.264
4.00	1.00	0.750	0.318

12.0 REFERANCE TABLES AND CONVERSION FACTORS

12.1 Hardness conversions and equivalent tensile strength

VICKERS HARDNESS NUMBER HV	BRINELL HARDNESS NUMBER BHN	ROCKWELL C HRC	EQUIVALENT ULTIMATE TENSILE STRENGTH	
			N/mm	Tons/m
500	-	49.7	1599	103
490	-	49.0	1560	101
480	-	48.2	1536	99
470	446.5	47.5	1504	97
460	437.0	46.7	1472	95
450	427.5	45.9	1441	93
440	418.0	45.1	1409	91
430	408.5	44.3	1377	89
420	399.0	43.5	1345	87
410	389.5	42.6	1314	85
400	380.0	41.7	1282	83
390	370.5	40.8	1250	81
380	361.0	39.8	1219	79
370	351.5	38.8	1100	77
360	342.0	37.8	1155	75
350	332.5	36.8	1124	73
340	323.0	35.7	1092	71
330	313.5	34.5	1059	60
320	304.0	33.5	1020	67
310	294.5	32.2	997	65
300	275.5	30.9	965	62
290	266.0	29.6	934	60
280	256.5	28.2	902	58
270	247.0	26.7	870	56
260	237.5	25.1	838	54
250	228.0	23.5	807	52
240	218.5	21.8	774	50
230	209.0	20.0	743	46
220	199.5	-	712	44
210	190.0	-	680	42
200	180.5	-	648	38
190	171.0	617	40	36
180	161.5	-	584	34
170	152.0	-	553	32
160	142.5	-	522	30
150	133.0	-	480	28
140	123.5	-	458	-
130	-	-	427	-

12.2 TENSILE STRENGTHS OF HEAT TREATED STEELS

HEAT TREATMENT CONDITION	TENSILE STRENGTH RANGE	
	N/mm	Tons/m
P	550 - 700	34 - 45
Q	625 - 775	40 - 50
R	700 - 850	45 - 55
S	775 - 925	50 - 60
T	850 - 1000	55 - 65
U	925 - 1075	60 - 70
V	1000 - 1150	65 - 75
W	1075 - 1225	70 - 80

12.3 USEFULL CONVERSION FACTORS

TO CONVERT			TO		MULTIPLY BY
Length:	Inch	(In)	metre	(m)	0.0254
	feet	(n)	metre	(m)	0.3048
Area:	square inch	(In2)	square millimetre	(mm2)	645.16
Volume:	cubic inch	(In3)	cubic metre	(m3)	16.30x10'6
	cubic foot	(n3)	cubic metre	(m3)	0.02832
Mass:	kilogramme	(kg)	newton	(N)	9.807
	pound	(lb)	newton	(N)	4.448
	pound	(lb)	kilogramme	(kg)	0.4530
Torque:	pound force inch	(lbf.in)	kilogramme force metre	(kgf.m)	0.0115
	pound force inch	(lbf.in)	newton millimetre	(Nmm)	113.0
Pressure/	pound per square inch	(lb/in2)	newton per square millimetre	(Nmm2)	0.006895
Stress:	pound per square inch	(lb/in2)	newton per square millimetre	(Nmm2)	15.445

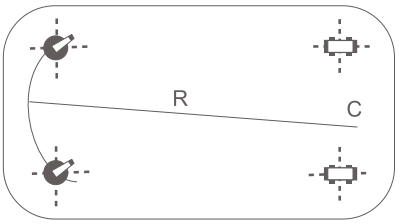
13.0 CASTORS

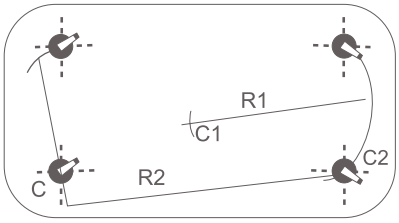
13.1 Examples of Possible Castor Arrangements

2 Swivel Castors and 2 Fixed Castors

Providing good load capacity and manoeuvrability, this arrangement ensures accurate steering even on long straight runs, making it the most practical arrangement for industrial use. Any trolley with this castor arrangement should be pushed with the fixed castors leading

Maximum loading for each castor = $\frac{\text{Gross Load}}{3}$





4 Swivel Castors

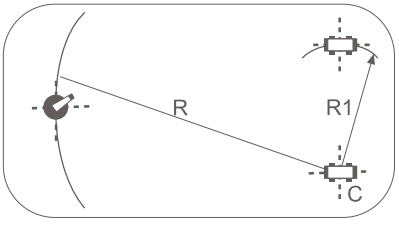
As this arrangement gives good load capacity with exceptional manuverabillity, it is suitable for winding runs and where sideways action is required. It is not recommended for straight runs or ramps, as it may be hard to guide, especially over bumpy terrain and when heavily loaded. However, equipping two castors with directional locks makes this arrangement very versatile and suitable for long straight runs.

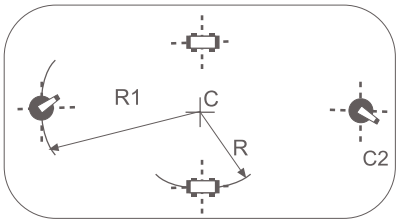
Maximum loading = $\frac{\text{Gross Load}}{3}$ for each castor

1 Swivel Castor and 2 Fixed Castors

This arrangement provides an economical solution for lightly loaded trolleys requiring good manoeuvrability. The trolley must be reasonably small in size and any load must be evenly distributed to ensure stability.

maximum loading for each castor = $\frac{\text{Gross Load}}{2.5}$





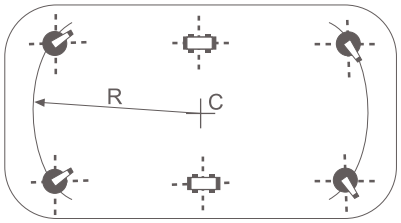
2 SWIVEL Castors and 2 Fixed Castors centrally pivoting

Ideal for confined spaces this arrangement provides good load capacity with excellent manoeuvrability. The fixed castors can be replaced by an 'A' series axle assembly and wheels which pivot the trolley centrally. In this case, 25mm of packing is necessary above the two fixed castors (wheels) to give alternating load support. However if the trolley is tipped or the load is not evenly distributed the swivel castors are subjected to shock loads.

The entire load rests on the two central, fixed castors/wheels

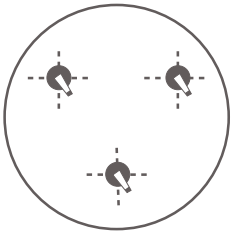
Maximum loading for each wheel/castor = $\frac{\text{Gross Load}}{2}$

4 Swivel Castors and 2 Fixed Castors centrally pivoting
This arrangement provides an extremely high load capacity, with great manoeuvrability and stabillity.This is ideal for very long trolleys destined to carry heavy loads. The fixed castors can be replaced by wheels mounted onto a central 'A'series axle. The units base must be robust and the swivel castors are mounted to allow the trolley to pivot on the central wheels. Therefore, 25mm of packaging is required above the two fixed castors(wheels) to give alternating load support, depending on which pair of wheels is in contact with the floor. The entire load rests on 2 central, fixed castors/wheels.



Please note that the swivel castors are subjected to shock loads if the trolley is tipped or the load is not evenly distributed.

Maximum loading for each wheel/castor = $\frac{\text{Gross Load}}{2}$

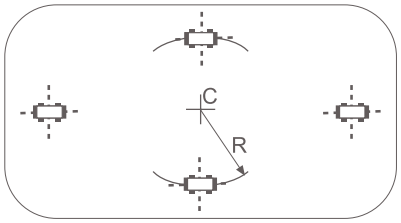


3 Swivel Castors
This provides good load capacity with excellent manoeuvrability, However equipment with this arrangement will be difficult to guide on straight runs particularly over uneven ground This arrangement is ideal for barrel dollies and small portable machines.

Maximum loading for each wheel = $\frac{\text{Gross Load}}{2.5}$

13.1

13.1.1
2 Fixed Castors centrally pivoting
Suitable for moderate loads and long, straight runs with occasional changes in direction. The two central fixed castors can be replaced by wheels mounted onto a central 'A' series axle. The two end castors are mounted as to pivot the trolley centrally, 25mm of parking is necessary above the central castors (wheels) to give alternating load support. However if the trolley is tipped or the load is not evenly distributed, the end castors are subject to shock loads. The entire load rests on the 2 central, fixed castors/wheels.



Maximum loading for each wheel/castor = $\frac{\text{Gross Load}}{2}$

13.1.2 Correct alignment of castors

1) Fixed and directional lock swivel castors - the mounting holes in the top plates are clearance holes and it is essential to align the castors to sign the castors correctly before the bolts are finally tightened.
2) Swivel castors - It is essential they are mounted with the swivel axis vertical

13.1.3 IMPORTANT NOTE The formulae above for the maximum loading for each castor is for an equally distributed load.

13.2 Load rating

13.2.1 Limitations to stand maximum load rating for each model number:-
a) Untyred wheels - refer to design data para 2.0
b) rubber tyred wheels - refer to design data para 3.0
c) Polyurethane tyred wheels - refer to design data para 4.0

13.2.2 Floor Conditions
The stated maximum load rating for each model assumes that the floor is reasonably level and free from cracks, obstructions, guide rails, gullies etc.

If any of the above are present on the operating environment then a castor with a load rating several times greater than calculated must be used. In addition the wheel diameter must be large enough to easily manoeuvre over cracks, ridges and other obstructions.