

4 Pulleys

4 Pulleys

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4.1 - Introduction

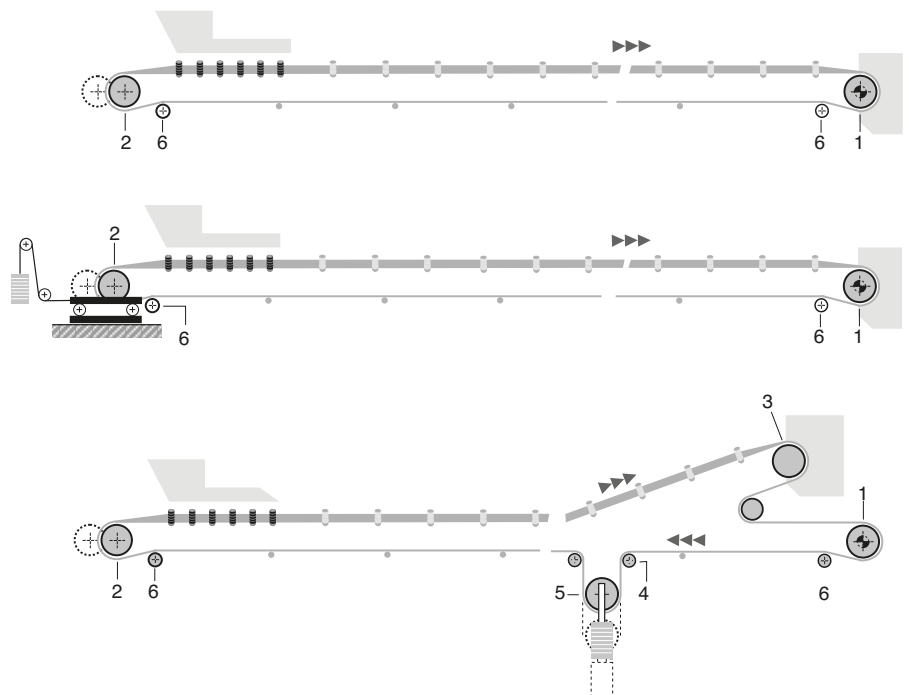
Pulleys are dimensioned according to the characteristics of each conveyor and may be designed to meet a great variety of construction methods.

For over 60 years Rulmeca has designed and manufactured pulleys, using materials of the highest quality in a production process employing advanced technology. This together with the application of the Quality Assurance system certified to ISO 9001:2015, contributes to the production of high quality products offering

dependable, long life performance in the field and appreciably reducing maintenance costs.

In the following drawings various arrangements of traditional belt conveyors are shown, with the pulleys numbered and described according to their function and position in the belt conveyor layout.

- | | |
|-------------------|-----------------------------|
| 1 - drive pulley | 4 - change direction pulley |
| 2 - return pulley | 5 - tension pulley |
| 3 - return pulley | 6 - snubbing pulley |



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4.2 - Dimension of pulleys

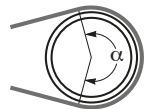
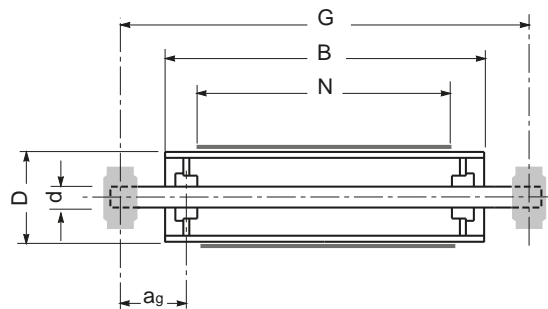
According to the position that they occupy in a belt conveyor, the pulleys must withstand the forces imposed by both belt tension and conveyed load.

To be as efficient as possible both for replacement and for new installation, proper selection of pulleys requires the following data that allows the determination of the construction characteristics and dimensions.

The principal data necessary to design a pulley comprises the following:

- belt width;

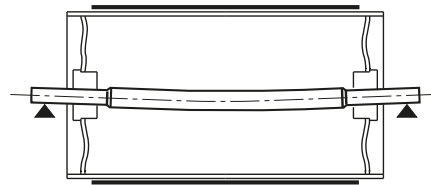
- diameter of drum in relation to the belt type and characteristics;
- locking arrangement of the shaft to the pulley (locking ring, key, welding);
- position of pulley (drive, return, snub etc...);
- wrap angle of belt on pulley " α ";
- belt tensions T_1 , T_2 or T_3 ;
- distance between the supports and flange of the pulley " a_g ";
- type of lagging as required.





4.2.1 - Shaft importance

Excessive deflection of the pulley shaft constitutes the major reason for failure of the drum structure.



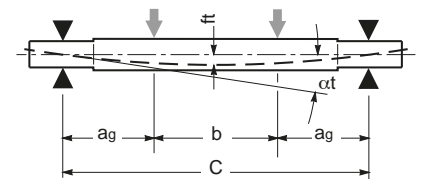
The correct sizing of the shaft is therefore of the greatest importance and must take into account an extra high safety factor.

Limitation of deflection and rotation

After having sized the diameter of the shaft for various pulleys, the next selection check is to verify that the deflection of the shaft does not exceed allowable values.

In particular the deflection "ft" and the angle of inclination "αt" must respect the relationship:

$$ft_{max} \leq \frac{C}{2000} \quad \alpha t \leq \frac{1}{500}$$



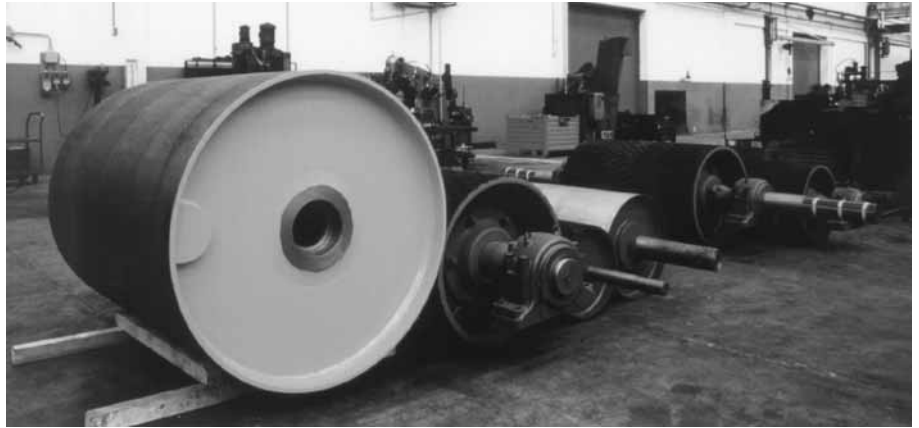
$$ft = \frac{(Cpr/2)a_g}{24 \times E \times J} [3(b+2a_g)^2 - 4a_g^2] \leq \frac{C}{2000}$$

$$\alpha t = \frac{(Cpr/2)}{2 \times E \times J} a_g (C - a_g) \leq \frac{1}{500}$$



Upon the request for pulleys with characteristics and dimensions different from those indicated in this catalogue it is advisable to supply a dimensioned drawing of the pulley with the required features.

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4.3 - Used Worldwide in important applications.

Rulmeca belt pulleys are the drive element for belt conveyors in bulk handling applications.

The Rulmeca belt pulleys have the shaft assembled by friction lock clamping units. Up to now this is the most used and reliable solution, granting strength, perfect centering, reliability and possibility of eventual future disassembly.

The pulleys are designed according to customer's requests.

The design and calculation is based on the current standards and can be verified by the FEM Finite Elements Modeling analysis.

Pulleys types

Drive pulleys, Idler Pulleys, Snub Pulleys, special pulleys etc.

Diameter

- Standard: 220 ÷ 1000
- Other dimensions on request.

Shell

- Shell width up to 4000 mm.
- Crowned or cylindrical shell

Shaft/Axles

- Fixed by self centering clamping units with tapered sleeves.
- Drive shafts: single or double drive shaft ends.

Bearings

- Pillow blocks or flange bearings of primary brands.
- Sealing system according to the application (e.g. double lip seals, labyrinth seals, taconite seals, shaft sealing rings etc.).

Rubber Lagging

- Hot vulcanized rubber lagging: smooth, diamond pattern or herringbone pattern.

Corrosion protection

- Different standard and special paint coats available, according to the application.
- Shaft ends temporary protected against corrosion by waxed oil.

General

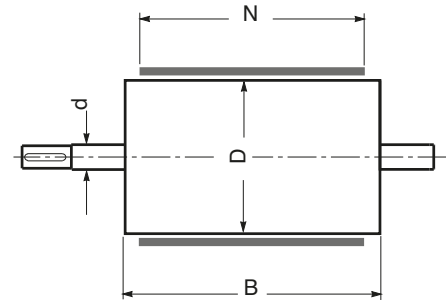
- Stress relieve thermal treatment on all the pulleys welding.
- All pulleys are statically balanced.

Options (on request)

- Materials certification
- Magneto scope checks
- Ultrasounds checks
- Dynamic balancing
- Rubber lagging with ceramic inserts
- Plates or pins for speed sensors
- Shaft with holes for speed check devices
- High resistance, quenched and tempered steel shaft

4.4 - Order code

Pulleys are identified according to the following characteristics:



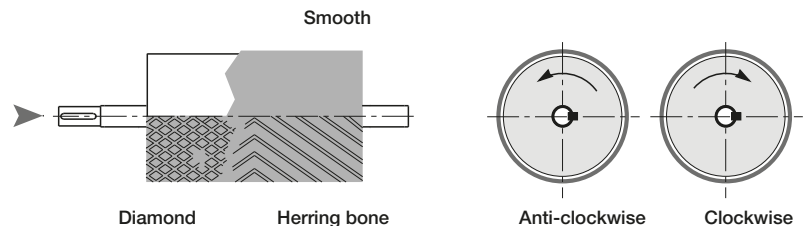
	USC	-630	-750	-40	YA	RA	12
Example:							
Pulley series							
Diameter of shell							
Length "B" of shell							
Diameter of shaft (corresponding to the bearings)							
System of end cap finish **							
Lagging *							
Thickness of lagging							

* - the lagging must be specified as: the form, the thickness and in the case of lagging cut as herringbone, the rotational sense of the pulley as seen from the drive side, as the following list:

- R - lagged in smooth rubber
- RR - lagged in rubber diamond pattern
- RA - lagged in rubber herringbone pattern, sense anti-clockwise
- RO - lagged in rubber herringbone pattern, sense clockwise

The type of standard rubber supplied for the lagging: hardness 60 or 70 Shore A, colour black, anti-abrasive.

On request it is possible to supply different hardnesses or types.



** System of pulley end cap finish

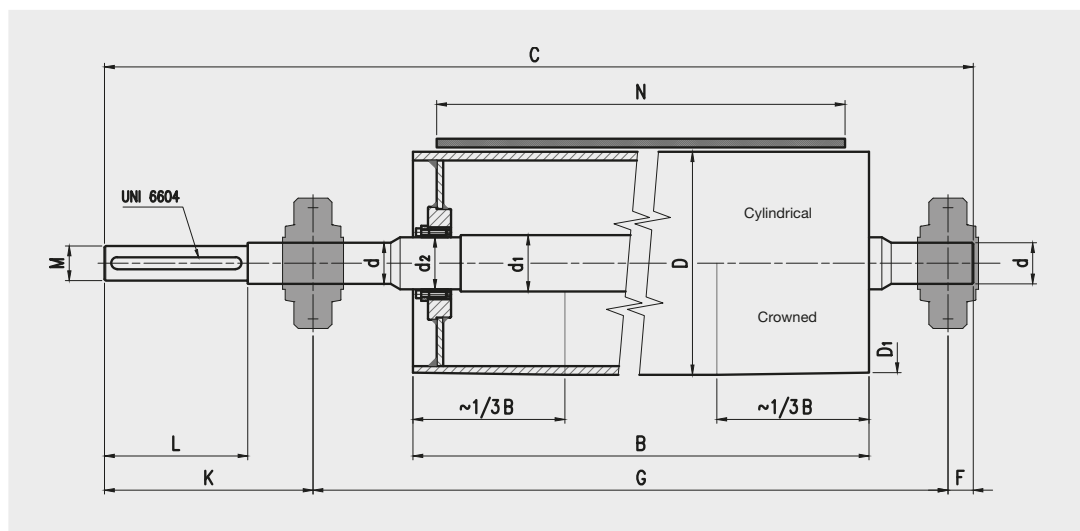
Symbol	Description of treatment
YA	painted with antirust primer, zinc phosphate based 40 micron, colour grey
YB	sandblasted SA 2,5 + epoxy rich-zinc primer 70 micron, colour grey
YC	sandblasted SA 2,5 + epoxy rich-zinc 40 micron + epoxy enamel 60 micron, colour grey RAL 7035
YS	special paint finish as requested (specify)

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4.5 - Programme

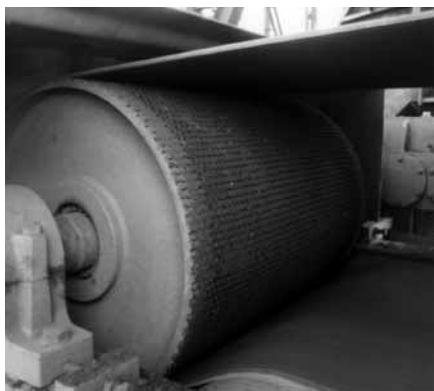
Pulleys type	Series	Design
USC	drive pulleys	with clamping units
USF	idler pulleys	with clamping units
CUF	idler pulleys	with incorporated bearings
TDV	screw tension units	simple
Special PULLEYS		

Series
USC drive
 with clamping units



4.5.1 - Drive pulleys with clamping units

To require this type of pulleys, please fill in and send the form with the required data for the pulleys selection at page 253.



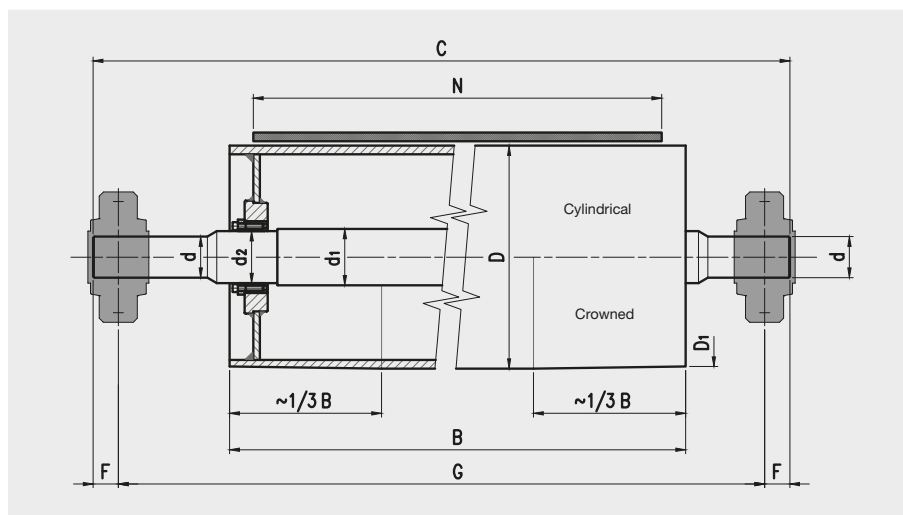
For the order code of execution and lagging see page 249.

Example of ordering
 standard design
 USC,800,1150,100,YA,RR,12

4 Pulleys

Series

USF idler
with clamping units



4.5.2 - Idler pulleys with clamping units

To require this type of pulleys, please fill in and send the form with the required data for the pulleys selection at page 253.



For the order code of execution and lagging see page 249.

Example of ordering
standard design
USF,620,750,50, YA,RO,10



4.5.3 Required data for the pulleys selection

☐ USC ☐ USF

Necessary data

- Pulley diameter
- Shell width
- Belt width
- Lagging type
- Bearings centre to centre distance
- Max radial load
- Belt speed
- Shaft diameter at the bearings
- Shaft diameter at the clamping units
- Length for the motor (only for use)

ø D	.....	mm
B	.....	mm
N	.....	mm
G	.....	mm
T1+T2	.....	N
v	.....	m/s
ø d	.....	mm
ø d2	.....	mm
L	.....	mm

Additional information

- Input torque
- Motor power
- Shaft diameter to the gearbox
- Belt wrap angle on drive pulleys USC
- Requested bearing sealing system or for special operating condition
- High friction lagging type
- Shell design

	.....	Nm
	.....	kW
ø M	.....	mm
	.....	°degrees
	
	
<input type="checkbox"/> crowned	<input type="checkbox"/> cylindrical	

Options (on request)

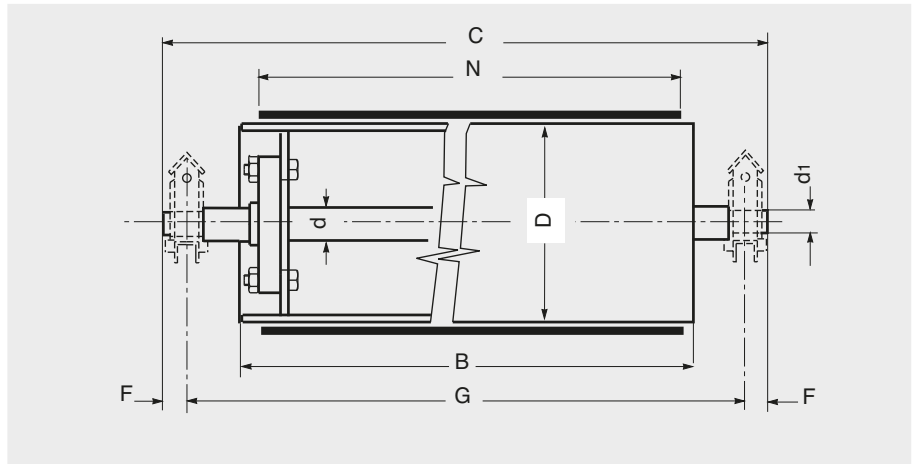
- Materials certification
- Magneto scope checks
- Ultrasounds checks
- Dynamic balancing
- Rubber lagging with ceramic inserts
- Plates or pins for speed sensors
- Shaft with holes for speed check devices
- High resistance, quenched and tempered steel shaft

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Series

CUF idler

with incorporated bearings



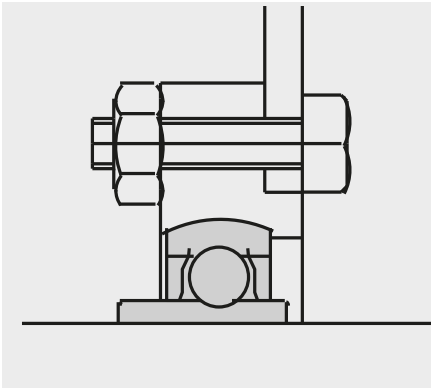
4.5.4 - Idler pulleys with incorporated bearings

Essentially a simplified construction, using radial ball bearings in a moveable housing designed into the pulley itself.

This system lends itself to be used together with the screw tensioning unit. Normally used as tail pulleys for small or medium loaded conveyors, and naturally only for idler type pulleys (not driven).

This type of pulley and tension units TDV are suggested for use on belt conveyors length not up to 50 m.

2



On request pulleys may be supplied with characteristics and dimensions different from those indicated in the table, or using the customer's drawing.

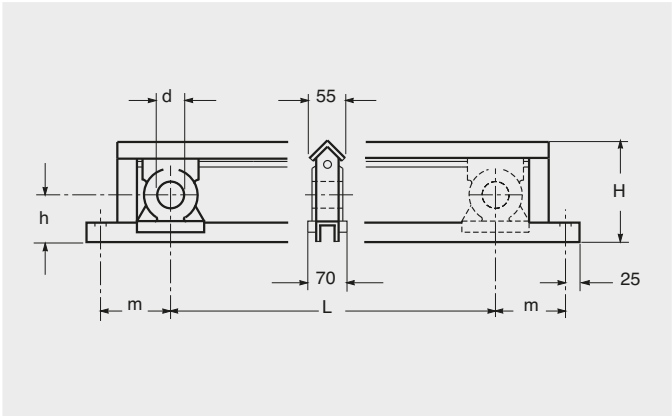
Belt width mm	Pulley type	D mm	B	d	d1	F	G	C	Weight Kg
400	CUF	190	500	40	38	30	760	820	28
		270							36
		320							44
500	CUF	190	600	40	38	30	860	920	47
		270		40	38				57
		320		40	38				79
		400		50	48				130
650	CUF	270	750	40	38	30	1010	1070	50
		320		40	38		1010	1070	61
		400		50	48		1050	1110	81
		520		60	58		1050	1110	136
800	CUF	320	950	40	38	30	1210	1270	75
		400		50	48		1250	1310	105
		520		60	58		1250	1310	164
		620		70	68		1250	1310	197
1000	CUF	400	1150	50	48	30	1450	1510	123
		520		60	58				176
		620		70	68				236

For the order code of execution and lagging see page 249.

Example of ordering
standard design
CUF,400,600,50,YA

tension units

TDV with screw



4.5.5 - Screw tension units

Used only in combination with pulleys CUF with fixed shaft and internal bearings, in that a hole is positioned to accept a static shaft (the possibility of assembling external bearing supports has not been considered in these tension units)

The use is restricted only to the installation of the pulley at the tail of the belt conveyor of a length not more than 50 m, selecting the length of movement in relation to the presumed belt stretch.

Over the above length it is advisable to use other types of tension units.



Tension unit type	d mm	L	h	m	H	Weight Kg
TDV 01	38	300	75	110	165	9
02		400				10
03		500				11
04		600				12
05		700				13
06		800				15
07		900				16
08		1000				17
TDV 21	48	300	85	120	185	11
22		400				12
23		500				13
24		600				14
25		700				15
26		800				17
27		900				18
28		1000				19
TDV 41	58	300	85	120	185	10.5
42		400				11.5
43		500				12.5
44		600				13.5
45		700				14.5
46		800				16.5
47		900				17.5
48		1000				18.5

Example of ordering
standard design
TDV38,YA,300

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4.5.6 - Special pulleys

Following specific requests and, if possible, a reference drawing provided by the customer, Rulmeca is able to manufacture different types of special pulleys such as:

Type 1 - pulleys with shaft-to-hub connection by means of key locking device (instead of clamping units).

These pulleys, of more traditional design, may have some limitation if compared to those pulleys having a shaft-to-hub connection by means of clamping units: lower shaft strength due to the reduced diameter in the centre and to the grooves for the keys. Furthermore they have a lower centering precision between the shaft and the hubs and, in the frequent case of oxidation, the disassembly of the two parts can be very difficult if not impossible.

Type 2 - Pulleys with flanges directly welded to the shaft.

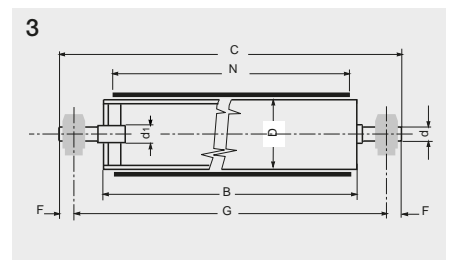
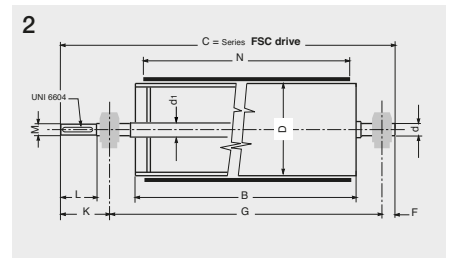
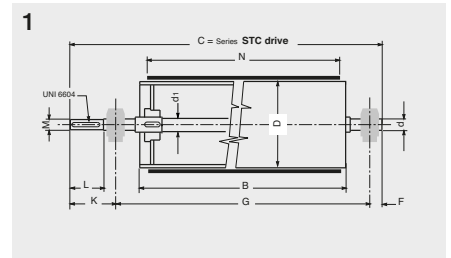
Type 3 - Pulleys without shaft, with flanges and stub axles.

These simplified types of pulleys are suitable only for light applications and should be used only for deviation, contrast or take up positions. Continuous service shaft substitution should not be foreseen for these pulleys.

For particular applications, where very wet materials are conveyed and the belt inner surface gets very dirty, special pulleys can be supplied such as:

Type 4 - squirrel cage pulleys

Type 5 - wing pulleys



Pulleys according to other types and dimensions than those described in this catalogue can be quoted and manufactured if requested and provided that the customer submits a drawing.

