ZERTIFIKAT ◆ CERTIFICATE ◆ 認証証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

Industrie Service

Certificate concerning the examination of conformity

Certificate no:	KP 067/2
Certification body:	TÜV SÜD Industrie Service GmbH Zertifizierungsstelle für Produkte der Fördertechnik Westendstr. 199 80686 München - Germany
Applicant:	Pfeifer Drako Drahtseilwerk GmbH & Co. KG Rheinstraße 19 - 23 45478 Mülheim an der Ruhr - Germany
Date of application:	2013-03-14
Manufacturer:	Pfeifer Drako Drahtseilwerk GmbH & Co. KG Rheinstraße 19 - 23 45478 Mülheim an der Ruhr - Germany
Product:	Rope drive, for use as part of the machine for traction drive lifts resp. indirect acting hydraulic lifts with and without reduced number of travels
Type:	Drako 250 T 6 mm / 6,5 mm / 8 mm
Test laboratory:	TÜV SÜD Industrie Service GmbH Zentralbereich Fördertechnik - Sonderbauten Abteilung Aufzüge und Sicherheitsbauteile Gottlieb-Daimler-Straße 7 70794 Filderstadt - Germany
Date and number of the test report:	2013-09-09 KP 067/2
Test specifications:	- Directive 95 / 16 / EC, Annex I - EN 81-1:1998+A3:2009 (D) - EN 81-2:1998+A3:2009 (D)
Result:	The equipment fulfills the requirements of the test specifications for the respective scope of application stated in the annex, page 1 - 5, of this certificate, keeping the mentioned conditions.
Validity:	2018-09-09
Date of issue:	2013-09-09

Certification body for lifts and cranes

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Annex to the certificate concerning the examination of conformity No. KP 067/2 dated 2013-09-09

1 Scope of application

1.1 Traction drive lifts and indirect acting hydraulic lifts, falling within the scope of validity of the Directive 95/16/EC (Lifts Directive) or whose rope drive / drive according to EN 81-1:1998+A3:2009 (D), number 12.2.1a) resp. EN 81-2:1998+A3:2009 (D), number 12.1.1b) will be renewed.

According the following definitions:

Traction drive lifts according EN 81-1:1998+A3:2009 (D)

Traction drive lifts without reduced number of trips	Rope safety factor (S_f) calculated according to EN 81-1:1998+A3:2009 (D), Annex N or equally good
Traction drive lifts with reduced number of trips	Rope safety factor (S_f) determined deviating from EN 81-1:1998+A3:2009 (D), Annex N

Indirect acting hydraulic lifts according EN 81-2+A3:2009 (D)

Indirect acting hydraulic lifts without reduced number of trips	Predicted number of trips ≥ 600.000
Indirect acting hydraulic lifts with reduced number of trips	Predicted number of trips < 600.000

1.2 Technical Data

Steel wire ropes of **Drako 250T** series

Characteristics of the rope	**Nominal diameter of the rope**	d_{Nom}	**6 mm** [1]	**6,5 mm** [1]	**8 mm**
	Minimum breaking load	F_{min}	26.8 kN	31.5 kN	43.3 kN 46,6 kN
	construction / type		8x19W + IWRC sZ U		
	Tensile strength of the wire	R_0	1770 N/mm²	1770 N/mm²	1570 N/mm² or 1770 N/mm²
Traction sheave	**Minimum diameter** [2]	D_{Tmin}	≥ 120 mm	≥ 120 mm	≥ 160 mm
		D_T / d_{Nom}	≥ 20	≥ 18,46	≥ 20
	V-angle in case of V-groove		γ = 35° to γ = 60°		
	U-angle in case of semi-circular undercut groove (U-groove)		β = 75° to β = 105°		
Diverting pulleys	**Minimum diameter** [2][3]	D_{Umin}	≥ 120 mm	≥ 120 mm	≥ 160 mm
		D_U / d_{Nom}	≥ 20	≥ 18,46	≥ 20

[1] Deviating from EN 81-1+A3:2009 (D), Number 9.1.2 a)
[2] Deviating from EN 81-1+A3:2009 (D), Number 9.2.1
[3] Deviating from EN 81-2+A3:2009 (D), Number 9.2.1

Note: The English text is a translation of the German original. In case of any discrepancy, the German version is valid only.

2 Conditions

2.1 For the determination of the minimum rope-safety-factor in case of lift installations with reduced number of trips, the document “Decision graphs DRAKO 250T d=6mm, 6,5mm und 8mm and their use Rev03“, dated 2013-09-06, with certification stamp of 2013-09-09, must be enclosed to the certificate concerning the examination of conformity no. KP 067/2 and its annex as support.

2.2 Conditions for traction lifts according EN 81-1:1998+A3:2009 (D)

2.2.1 The intended use of the lift installation must be coordinated between the rope manufacturer, the manufacturer of the lift and the person who makes the purchasing order (in case of new lifts) or operator (in case of modifications of the lift).

Especially a statement must be given with regard to the following points:

- The intended use of the lift
- The expected yearly number of trips
- The expected number of trips up to the moment when having reached the limit at which the steel wire ropes have to be discarded – for lift installations with a reduced number of trips –
- The rope safety factor which is required with respect to the lift installation

These statements and the calculations based on the statements must be documented and must be enclosed to the technical documents.

See number 3.3 of this certificate.

2.2.2 The rope safety factor must be determined

- In case of traction drive lifts <u>without</u> reduced number of trips
  According to EN 81-1:1998+A3:2009 (D), Annex N or equally good

or

- In case of traction drive lifts <u>with</u> reduced number of trips
  Corresponding to “Decision graphs DRAKO 250T d=6mm, 6,5mm und 8mm and their use Rev03“, dated 2013-09-06.

2.2.3 The rope safety factor must be at least $S_f = 12$.

2.2.4 In case of lift installations with reduced number of trips, the trips must be registered by a safe and reliable automatic counter device (e. g. by a power-fail proof, non-resettable electric counter).

When the number of trips after which the ropes have to be discarded is reached, the lift must be safely stopped in the next landing by the control system and the suspension ropes must be replaced.

See number 3.3 and 3.4 of this certificate.

2.2.5 The suspension ropes must be discarded in case of (for all lift installations)

- 26 broken wires within a length of 30 x d or
- 13 broken wires within a length of 6 x d or
- a diameter reduction of more than 6% related to the nominal rope diameter

and (for lift installations with a reduced number of trips)

- When reaching the maximum number of trips which has been determined by calculation.

2.2.6 The rope traction of the suspension ropes must be calculated according to EN 81-1:1998+A3:2009 (D), Annex M (informative) or equal.

2.2.7 The ratio between the diameter of the traction sheave and the rope diameter must be at least:

d_{Nom}	6 mm	6,5 mm	8 mm
D_T / d_{Nom}	≥ 20	≥ 18.46	≥ 20

2.2.8 The traction sheave must be designed with a semi-circular undercut groove (U-angle β = 75° up to β = 105°, hardened or non-hardened) or with a hardened V-groove (V-angle γ = 35° up to γ = 60°) made of steel or cast iron.

2.2.9 The ratio between the diameter of the diverting pulley and rope diameter must be at least:

d_{Nom}	6 mm	6,5 mm	8 mm
D_U / d_{Nom}	≥ 20	≥ 18.46	≥ 20

2.2.10 The diverting pulleys must be designed with a semi-circular groove made of steel or cast iron (hardened or non-hardened) or made of plastics.

2.2.11 All additional requirements of EN 81-1:1998+A3:2009 (D) regarding rope drives must be kept, e.g. like:

- junction of the rope termination (80% of the minimum breaking load)
- distribution of load of suspension
- protections at traction sheaves and pulleys (bracket against derailing of the rope, nip guards)
- visual examination on the traction sheave is guaranteed

2.3 Conditions for indirect acting hydraulic lifts according EN 81-2:1998+A3:2009 (D)

2.3.1 The intended use of the lift installation must be coordinated between the rope manufacturer, the manufacturer of the lift and the person who makes the purchasing order (in case of new lifts) or operator (in case of modifications of the lift).

Especially a statement must be given with regard to the following points:

- The intended use of the lift
- The expected yearly number of trips
- The expected number of trips up to the moment when having reached the limit at which the steel wire ropes have to be discarded – for lift installations with a reduced number of trips –
- The rope safety factor which is required with respect to the lift installation

These statements and the calculations based on the statements must be documented and must be enclosed to the technical documents.

See number 3.3 of this certificate.

2.3.2 The rope safety factor must be at least S_f = 12.

2.3.3 In case of lift installations with reduced number of trips reps. with a pulley made of plastic (at the piston), the trips must be registered by a safe and reliable automatic counter device (e. g. by a power-fail proof, non-resettable electric counter).

When the number of trips after which the ropes have to be discarded is reached, the lift must be safely stopped in the next landing by the control system and the suspension ropes must be replaced.

See number 3.3 and 3.4 of this certificate.

2.3.4 The suspension ropes must be discarded in case of (for all lift installations)

- 26 broken wires within a length of 30 x d or
- 13 broken wires within a length of 6 x d or
- a diameter reduction of more than 6% related to the nominal rope diameter

and (for lift installations with a reduced number of trips)

- When reaching the maximum number of trips which has been determined by calculation.

2.3.5 The ratio between the diameter of the diverting pulleys and rope diameter must be at least:

d_{Nom}	6 mm	6,5 mm	8 mm
D_U / d_{Nom}	≥ 20	≥ 18.46	≥ 20

2.3.6 The diverting pulleys must be designed with a semi-circular groove made of steel or cast iron (hardened or non-hardened) or made of plastics.

2.3.7 All additional requirements of EN 81-2:1998+A3:2009 (D) regarding rope drives must be kept, e.g. like:

- junction of the rope termination (80% of the minimum breaking load)
- distribution of load of suspension
- protections at pulleys (bracket against derailing of the rope, nip guards)
- visual examination on the traction sheave is guaranteed

3 Remarks

3.1 A sign with particulars for identification, containing the name of the manufacturer and the type specification must be attached at the product, to be able to check the conformity of the examined product with the series production.

3.2 The certificate concerning the examination of conformity may be used only in connection with the pertinent Annex.

3.3 The following installations will be regarded as lifts with a reduced number of trips.

3.3.1 Traction lifts according EN 81-1:1998+A3:2009 (D) with a deviating rope safety factor (smaller than the rope safety factor which is defined in EN 81-1:1998+ A3:2009 (D), Annex N).

The deviant rope safety factor (smaller than the rope safety factor which is defined in EN 81-1:1998+ A3:2009 (D), Annex N) is the result of the determined maximum number of trips, after which the steel wire ropes has to be discard.

In the case of a change of the intended use of the lift installation (using the lift more frequently), a improvement of the lift installation may become necessary.

3.3.2 Indirect acting hydraulic lifts according EN 81-2:1998+A3:2009 (D) with a determined maximum number of trips of less than 600.000 trips, after which the steel wire ropes has to be discarded.

In the case of a change of the intended use of the lift installation (using the lift more frequently), a improvement of the lift installation may become necessary.

3.4 Each change of direction is regarded as a trip which shall be registered by the automatic counting device.

Re-levelling movements as far as possible should be avoided. Re-levelling movements exceeding the range of $l/d_{Nom} > 10$ (bending length ratio = *bending length / nominal diameter of the rope*) – in case of a preceding change of direction – must be evaluated as a trip.

3.5 The following equivalent number of traction sheaves will be taken as basis:

	V-groove with groove angles γ of								
	35°	36°	38°	40°	42°	45°	50°	55°	60°
$N_{equiv\ (t)}$	18.5	15.2	10.5	7.1	5.6	4	3	2.5	2.2
	Semi-circular groove with undercut and undercut angles β of								
			75°	80°	85°	90°	95°	100°	105°
			2.5	3	3.8	5	6.7	10	15.2

Deviating from EN 81-1:1998+A3:2009 (D), table N.1 some additional V-grooves (V-angle γ = 50°, 55° and 60°) will be used, the corresponding equivalent number of traction sheaves $N_{equiv(t)}$ has been determined by extrapolation.

Note: The English text is a translation of the German original. In case of any discrepancy, the German version is valid only.

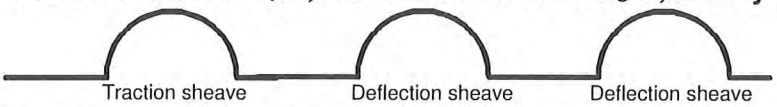
3.6 The test results refer to the test specimen and the corresponding examination of conformity only.

3.7 The list of safety components (annex IV of Directive 95/16/EC) doesn't contain rope drives. For that reason no EC type examination certificate according to annex V part A (EC type examination for safety components) of the Directive 95/16/EC, can be issued for that.

3.8 This certificate is based on the state of the art, which is documented trough the current harmonized standards. Changes resp. extensions of these standards or a further development of the state of the art may make a revision of this report necessary.

3.9 If new knowledge should occur, the test laboratory reserves the right, to give additional conditions concerning the use of the rope drive, or to modify existing conditions.

3.10 The certificate about an examination of conformity number KP 067/2 can be added to the required reading technical dossier as a help for decision of the notified body.

Theme:	**Decision graphs DRAKO 250T d=6mm, 6,5mm and 8mm and their use**
Parameters:	**Traction sheave D_T/d; Deflection sheave D_U/d; Safety factor S_f**
Bendings in most stressed rope zone:	
Revision status	**Rev03** Dated: **06.09.2013**

DRAKO 250T steel wire rope is designed for applications in elevators both within and outside the requirements of the EN81-1 and EN81-2.

In **traction elevators** the safety factor and/or the diameter ratio of traction- resp. deflection sheave to rope D/d can deviate from EN81-1. In EN81-1 annex N the calculation of the safety factor is based e.g. on a minimum number of trips $Z=6\cdot10^5$.

If the safety factor is within the requirements of EN81-1 Annex N, the elevator conforms to the standard. The conformity is also given if the number of trips is higher then the minimum number of trips $Z=6\cdot10^5$. Additional measures are not necessary for operation.

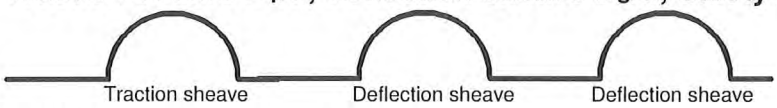
If the safety factor S_f is outside the requirements of EN81-1 Annex N, the elevator has to be handled as an elevator with a reduced number of trips. In this case a counter device has to be installed to count the number of starts. A trip is defined as the sum of all starts in one direction before reversal of direction. A start is considered to be the trip distance l>10xd — i.e. readjustment procedures are excluded. The limit is set in a way that the readjustment procedures are taken into account and the service life is practically no longer affected by the length of the bending zone.

The expected number of trips can be estimated using the following graphs for the case that the mostly stressed rope zone runs over the traction sheave and two deflection sheaves with a bending length of two floor intervals for different diameter ratios D/d and safety factor S_F. These graphs show "homogenous" D/d and "heterogeneous" D/d combinations of traction and deflection sheaves. Intermediate values can be interpolated. Example: A certain number of trips for a given D/d is sought. For a constant safety factor and for a in design stage defined groove shape, the number of trips for the next larger and the next smaller D/d can be found in the graphs.

The number of trips Z(D/d) has to be calculated by average determination of these two values. For intermediate groove angles linear interpolation within the graph can be used to evaluate the number of trips

$$Z_{ges} = Z_1 + (\beta_{ges} - \beta_1)\cdot\frac{Z_2 - Z_1}{\beta_2 - \beta_1}.$$

Where Z_{ges}, Z_1 and Z_2 represent the given number of trips and where β_1 and β_2 as well as γ_1 and γ_2 represent the groove angles related to the curves. With less stressed bending zones – i.e. less overruns – the expected number of trips will be exceeded.

Theme:	**Decision graphs DRAKO 250T d=6mm, 6,5mm and 8mm and their use**
Parameters:	**Traction sheave D_T/d; Deflection sheave D_U/d; Safety factor S_f**
Bendings in most stressed rope zone:	
Revision status	**Rev03** Dated: **06.09.2013**

In **hydraulic elevators** the diameter ratio of deflection sheave to rope D/d can deviate from EN81-2. In EN81-1 annex N the calculation of the safety factor is based e.g. on a minimum number of trips $Z=6\cdot10^5$.

If the D/d-ratio of **the steel- or iron cast sheave** is outside the requirements of EN81-2, then it has to be handled as an elevator with a reduced number of trips if the number of trips is less than the minimum number of trips $Z=6\cdot10^5$. In this case a counter device has to be installed to count the number of starts. A trip is defined as the sum of all starts in one direction before reversal of direction. A start is considered to be the trip distance l>10xd — i.e. readjustment procedures are excluded. The limit is set in a way that the readjustment procedures are taken into account and the service life is practically no longer affected by the length of the bending zone.

The expected number of trips in a hydraulic elevator can be estimated using the following graphs for the case that the mostly stressed rope zone runs over the deflection sheave with a bending length of two floor intervals for different diameter ratios D/d and safety factor S_F>12 following the graphs on page 15.

For intermediate values of safety factor (D/d=const.) and D(d-ratio (S_f=const.) a calculation with linear interpolation is admissibly.

The use of a **plastic deflection sheaves** increases the number of trips in the decision graphs by factor f_N=1,2. Using plastic deflection sheaves in hydraulic lifts in all cases makes a counter necessary.

The decision graphs are valid for the run over one deflection sheave. The seldom case, that the most stressed bending rope zone runs over two deflection sheaves has be respected by halving the trips in the decision graphs.

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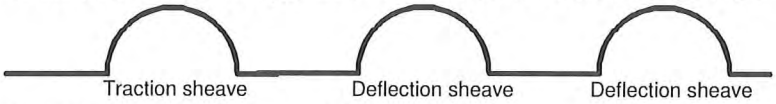
09. Sep. 2013

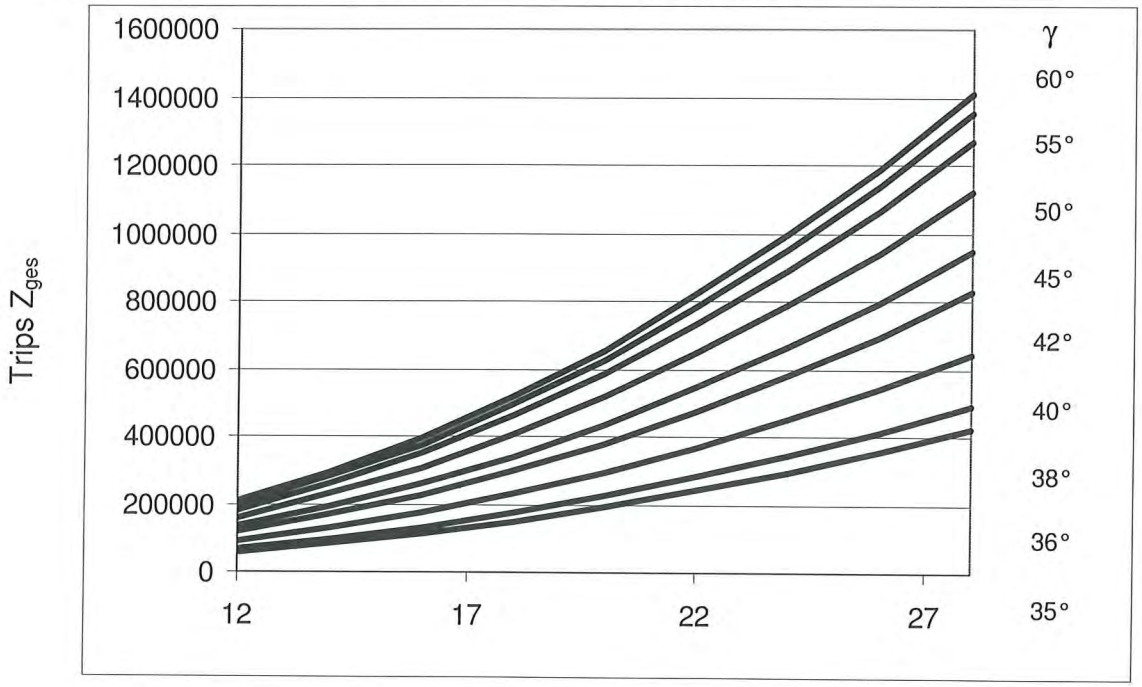
List of revisions

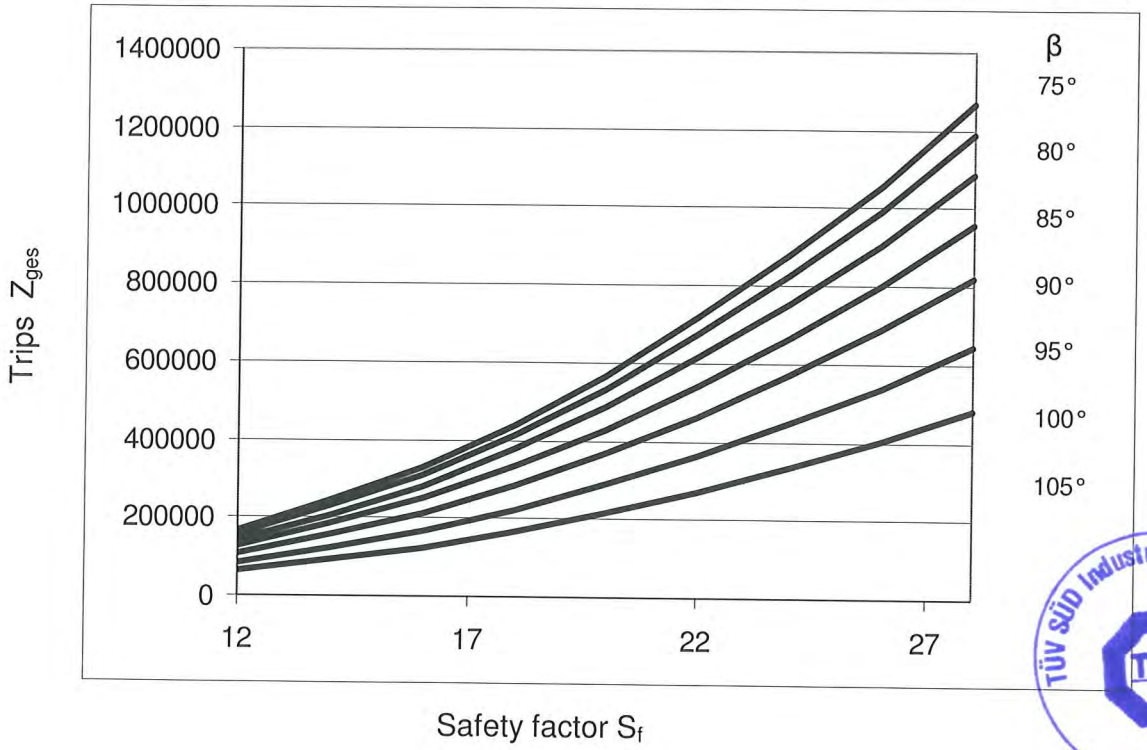
Rev01	24.07.2009	Traction elevators D/d ≥ 24,6
Rev02	24.01.2011	extension – use in hydraulic elevators D/d ≥ 24,6 and S_f ≥ 12 and d ≥ 6mm
Rev03	06.09.2013	extension – use of D/d≥20 for d=6 and 8mm and D/d≥18,46 for d=6,5mm

TÜV SÜD Industrie Service GmbH

09. Sep. 2013

Theme:	**Decision graphs DRAKO 250T d=6mm, 6,5mm and 8mm and their use**
Parameters:	**Traction sheave $D_T/d=35$ Deflection sheave $D_U/d=30$**
Bendings in most stressed rope zone:	
Revision status	**Rev03** Dated: : **06.09.2013**





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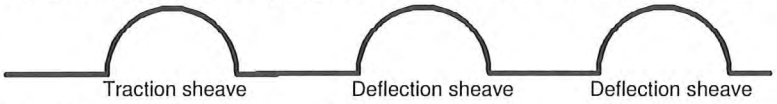
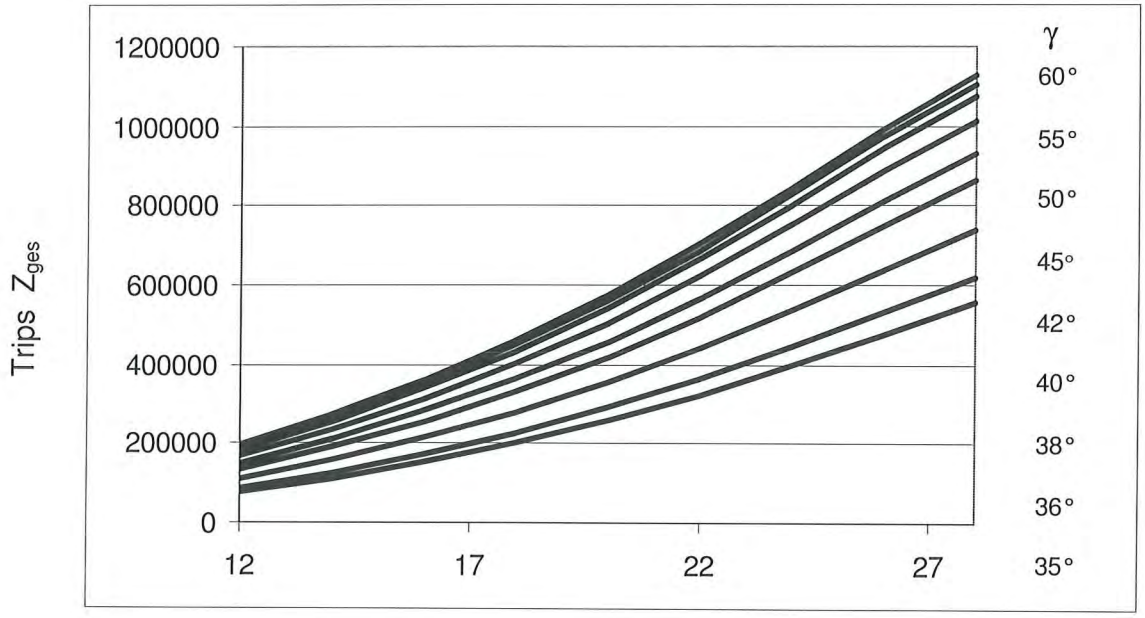
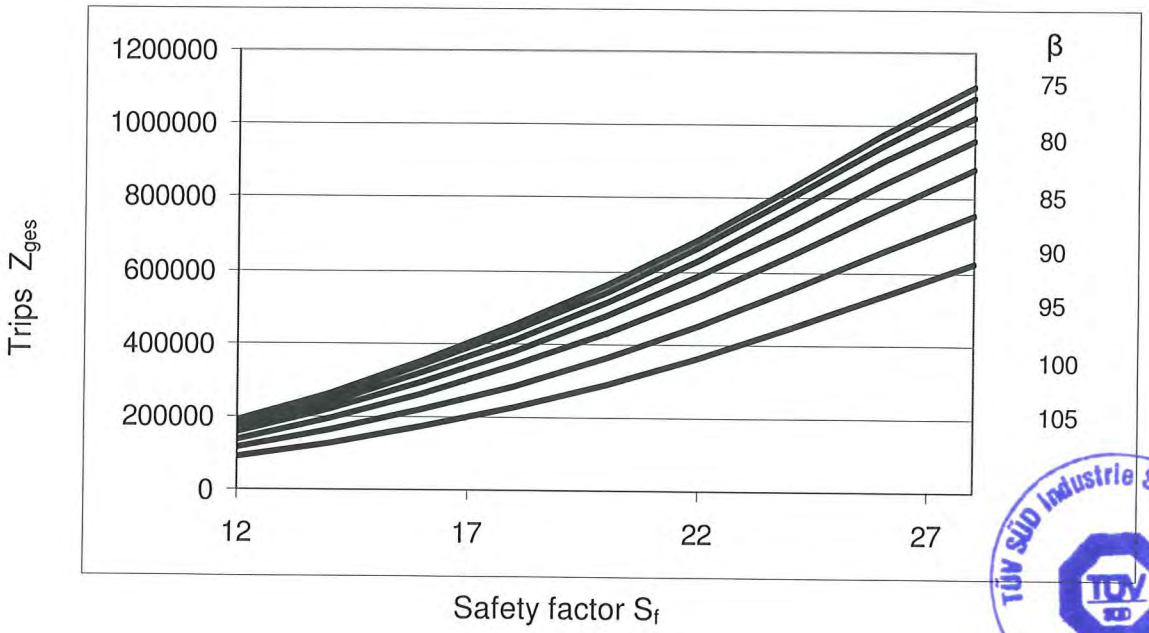
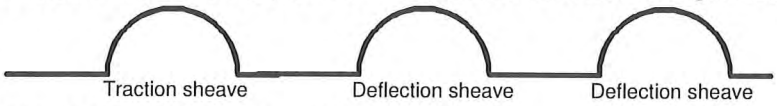
09. Sep. 2013

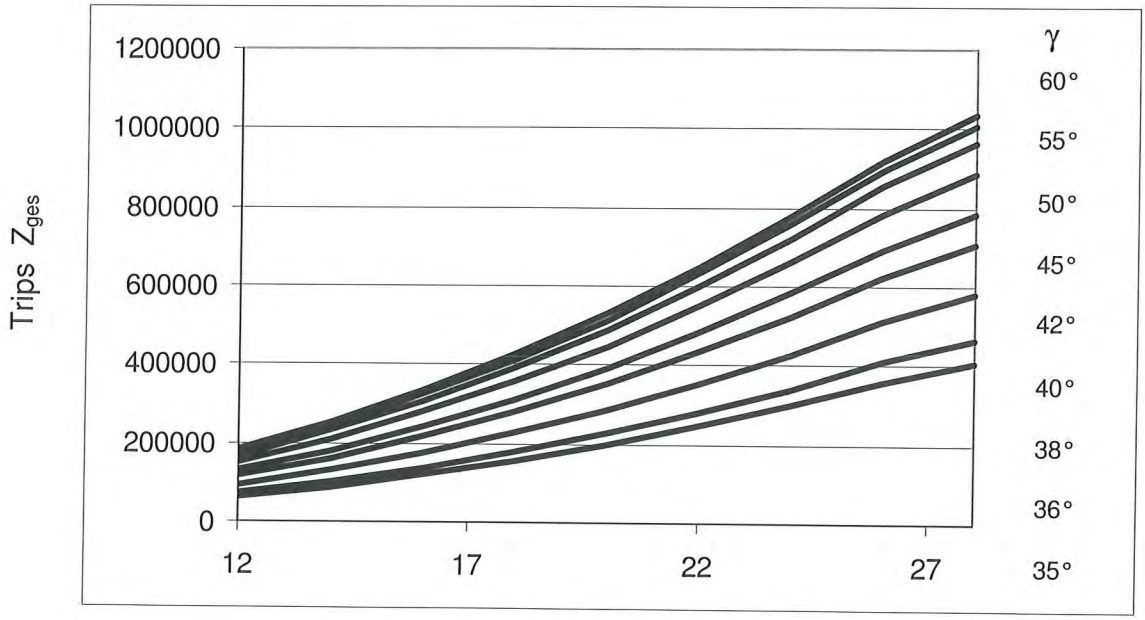
Theme:	**Decision graphs DRAKO 250T d=6mm, 6,5mm and 8mm and their use**
Parameters:	**Traction sheave $D_T/d=40$ Deflection sheave $D_U/d=25$**
Bendings in most stressed rope zone:	
Revision status	**Rev03** Dated: : **06.09.2013**

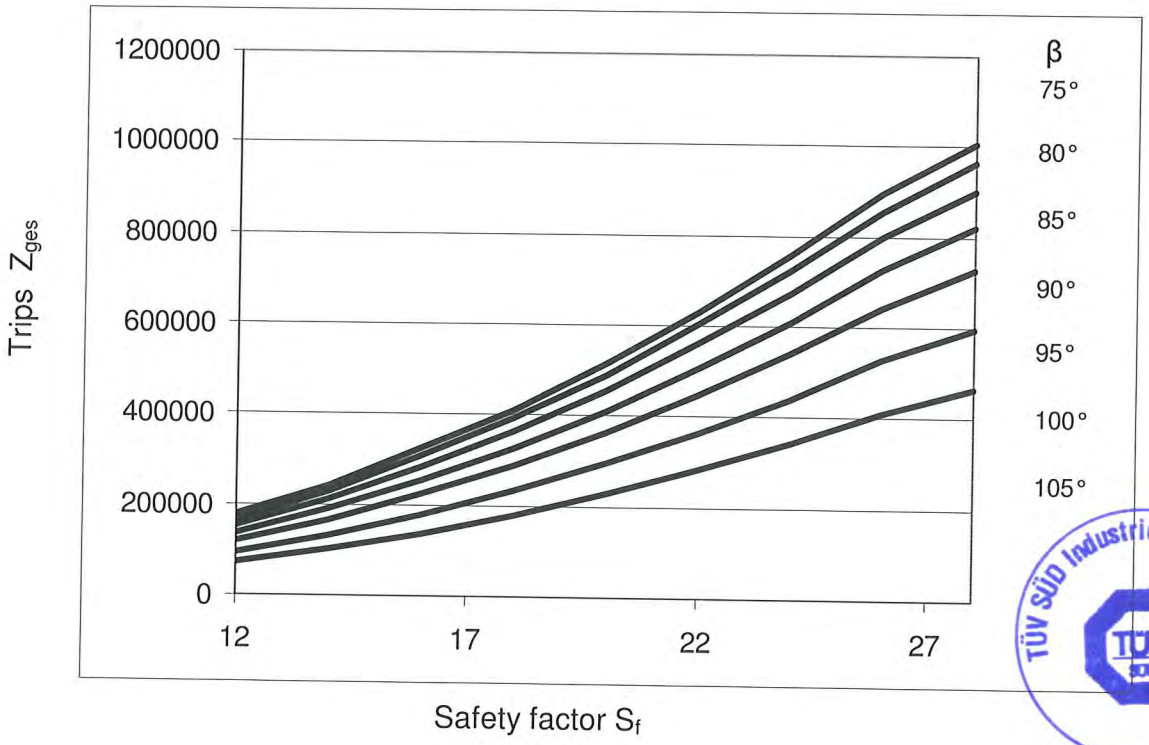




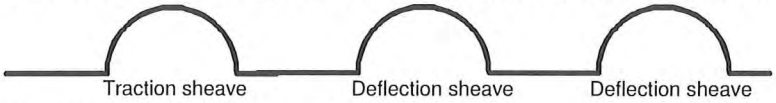
TÜV SÜD Industrie Service GmbH
09. Sep. 2013

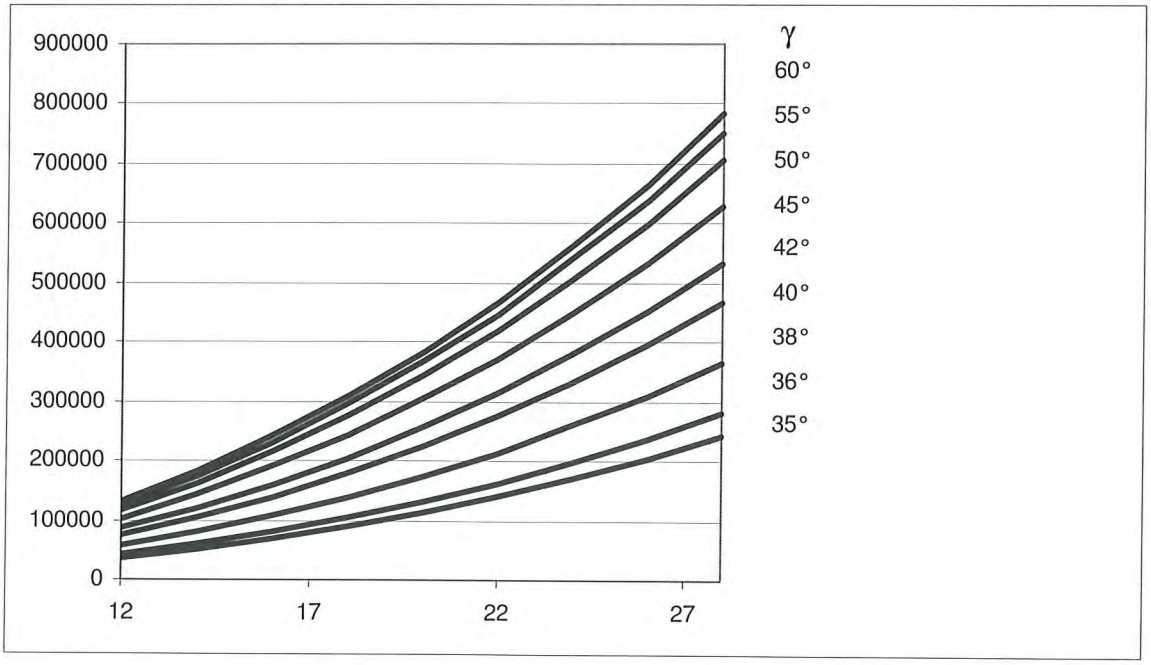
Theme:	**Decision graphs DRAKO 250T d=6mm, 6,5mm and 8mm and their use**
Parameters:	**Traction sheave $D_T/d=35$ Deflection sheave $D_U/d=25$**
Bendings in most stressed rope zone:	
Revision status	**Rev03** Dated: : **06.09.2013**

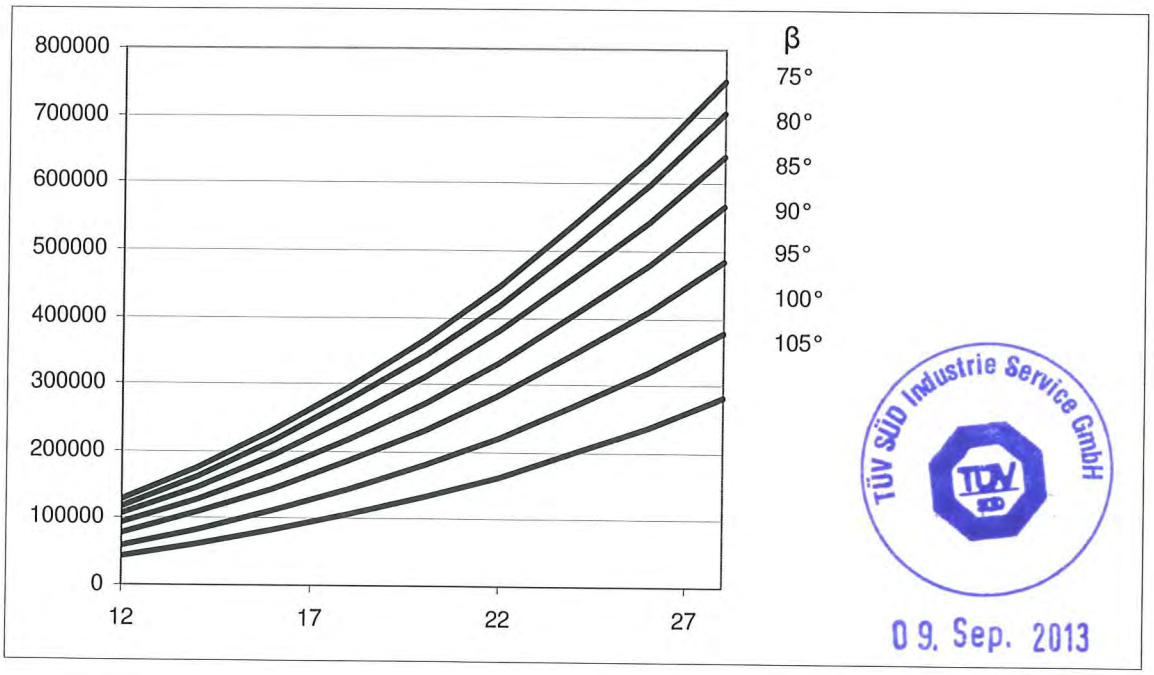




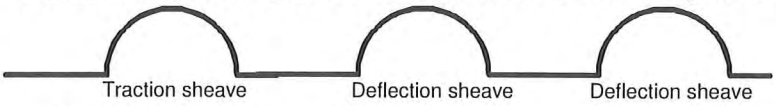
TÜV SÜD Industrie Service GmbH
09. Sep. 2013

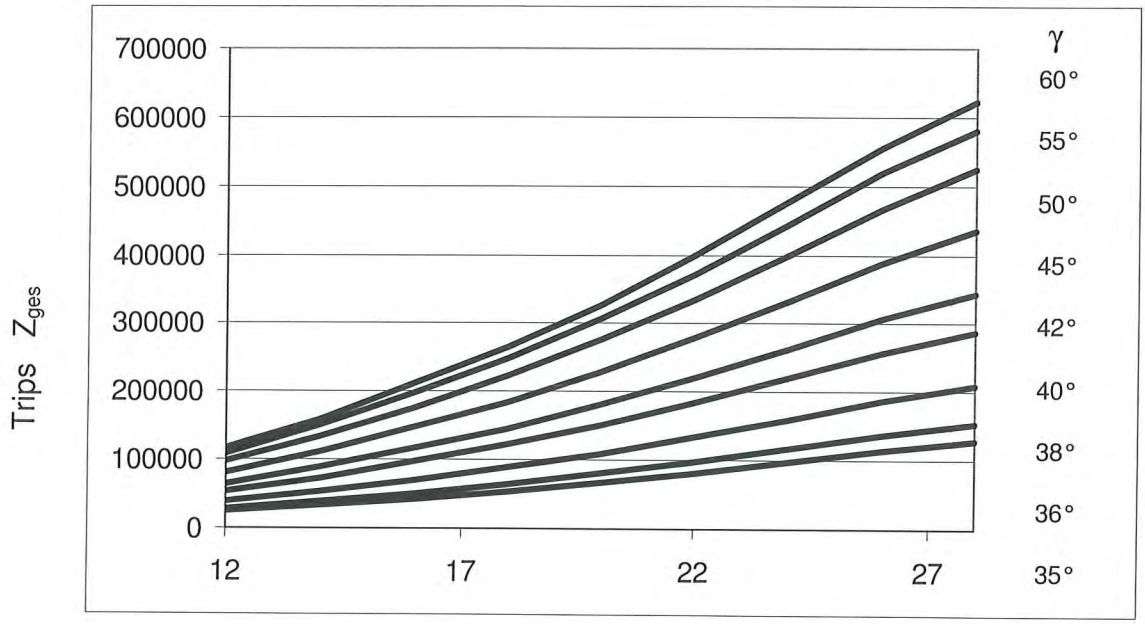
Theme:	**Decision graphs DRAKO 250T d=6mm, 6,5mm and 8mm and their use**
Parameters:	**Traction sheave $D_T/d=30$ Deflection sheave $D_U/d=25$**
Bendings in most stressed rope zone:	
Revision status	**Rev03** Dated: : **06.09.2013**

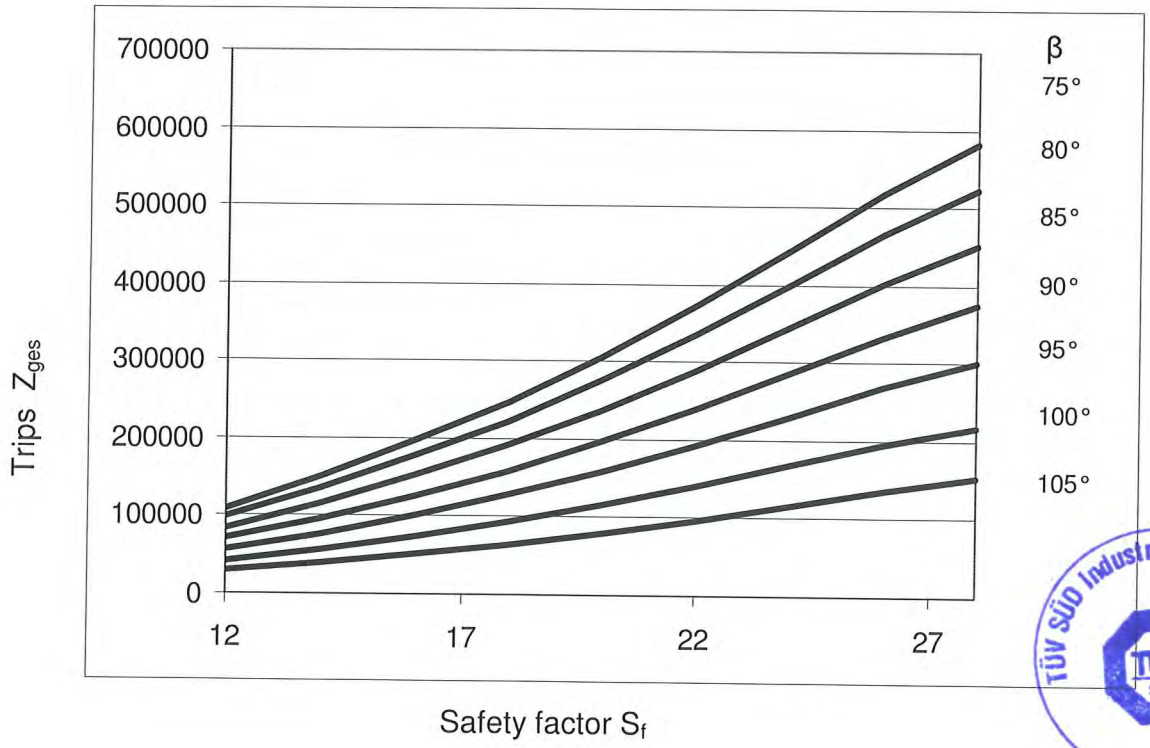




Safety factor

Theme:	**Decision graphs DRAKO 250T d=6mm, 6,5mm and 8mm and their use**
Parameters:	**Traction sheave $D_T/d=25$ Deflection sheave $D_U/d=25$**
Bendings in most stressed rope zone:	
Revision status	**Rev03** Dated: : **06.09.2013**





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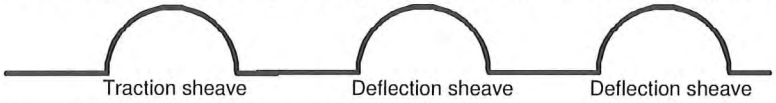
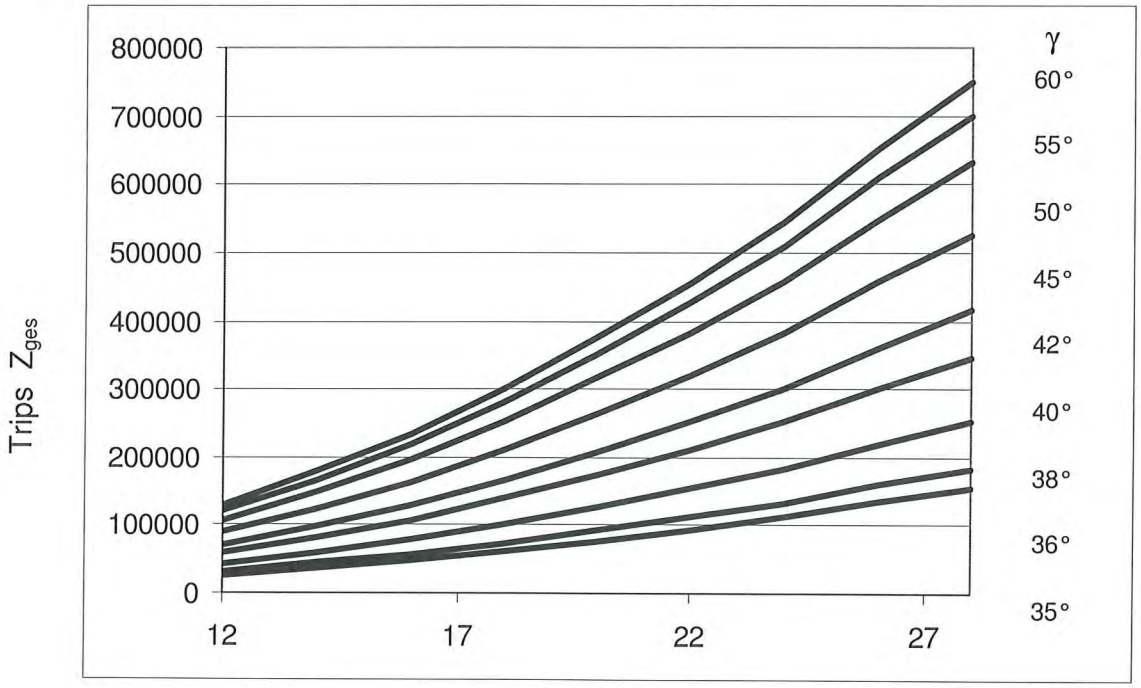
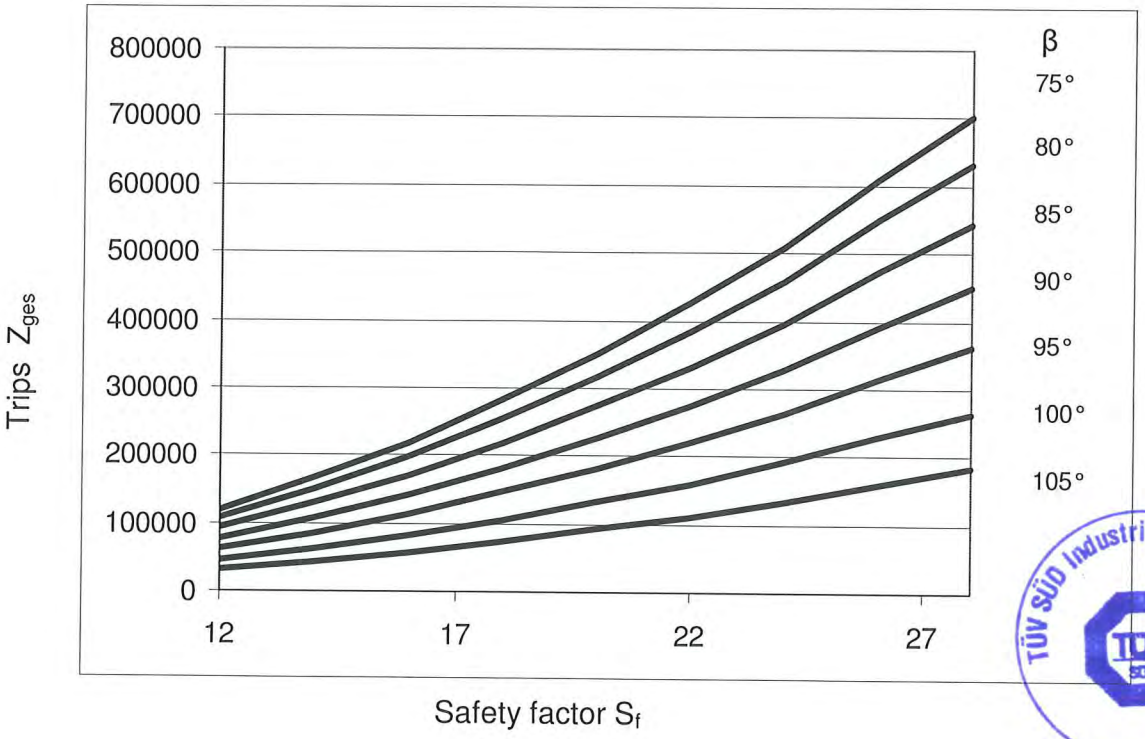
09. Sep. 2013

Theme:	**Decision graphs DRAKO 250T d=6mm, 6,5mm and 8mm and their use**
Parameters:	**Traction sheave $D_T/d=26,5$ Deflection sheave $D_U/d=26,5$**
Bendings in most stressed rope zone:	
Revision status	**Rev03** Dated: : **06.09.2013**





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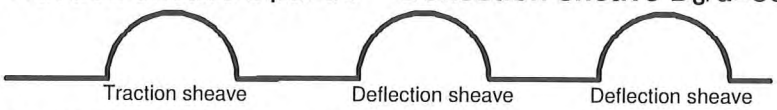
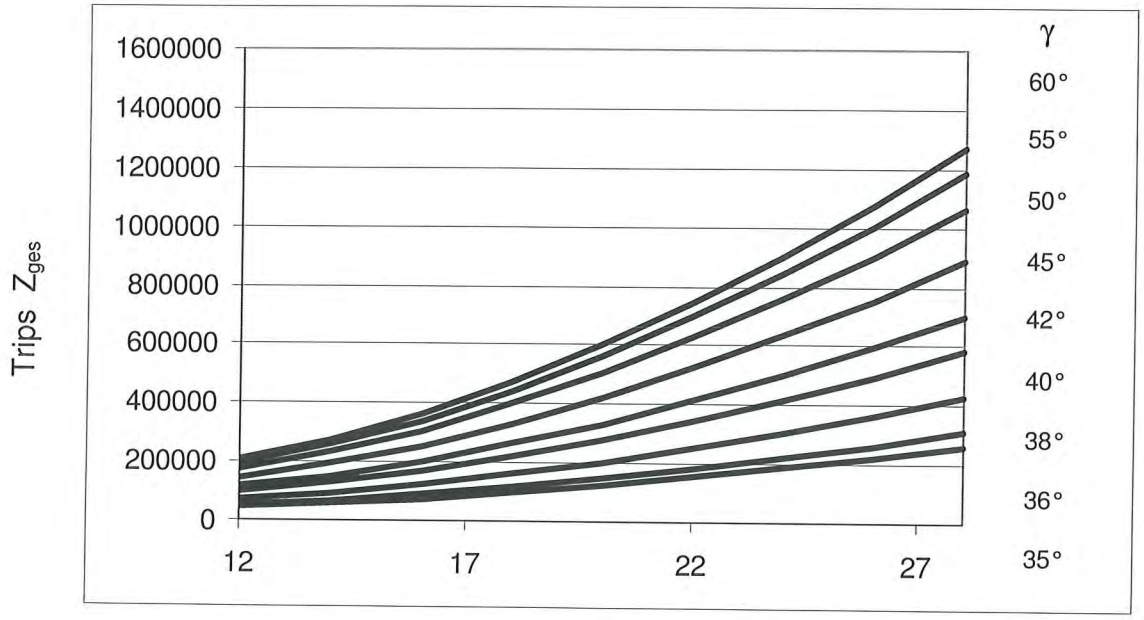
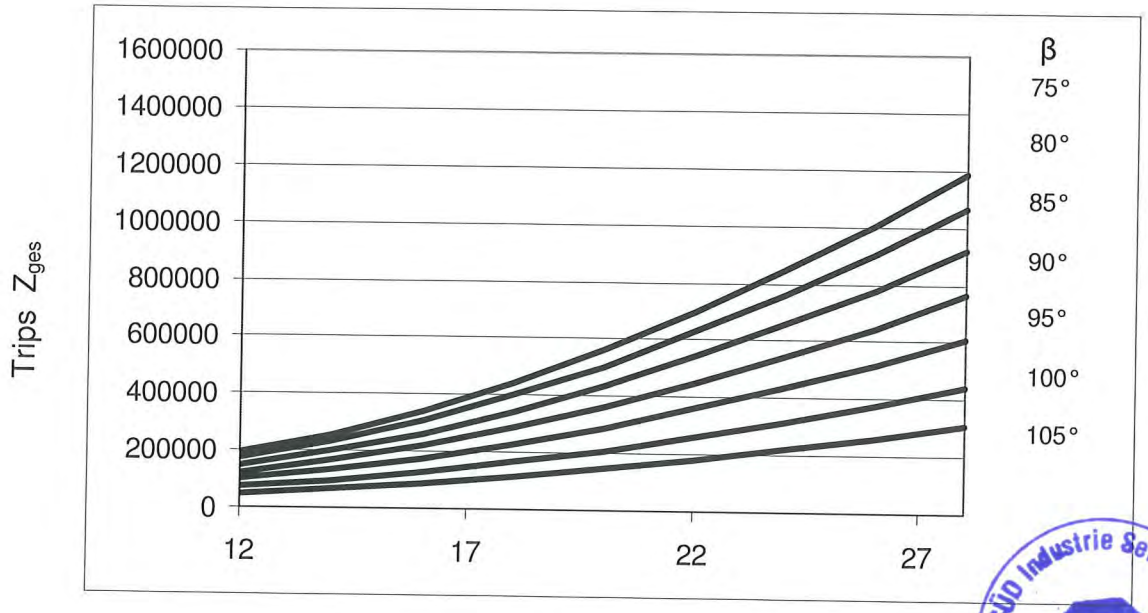
09. Sep. 2013

Theme:	**Decision graphs DRAKO 250T d=6mm, 6,5mm and 8mm and their use**
Parameters:	**Traction sheave $D_T/d=30$ Deflection sheave $D_U/d=30$**
Bendings in most stressed rope zone:	
Revision status	**Rev03** Dated: : **06.09.2013**





Safety factor S_f

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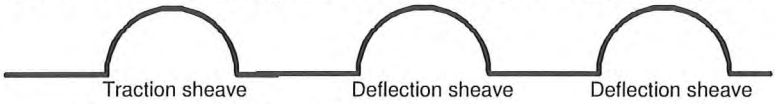
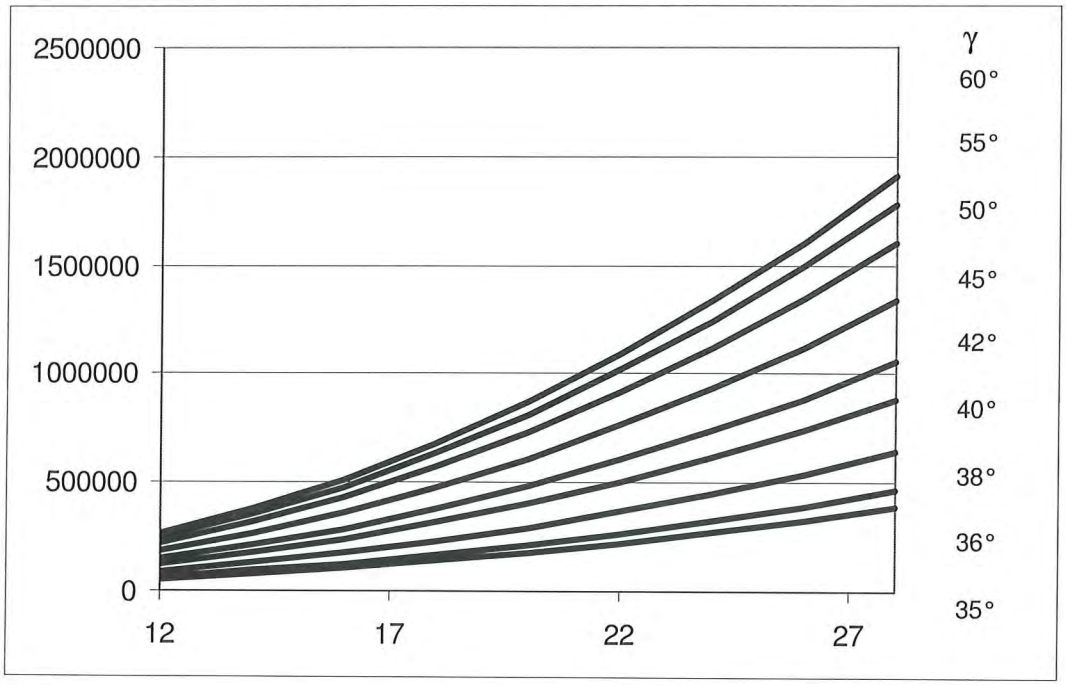
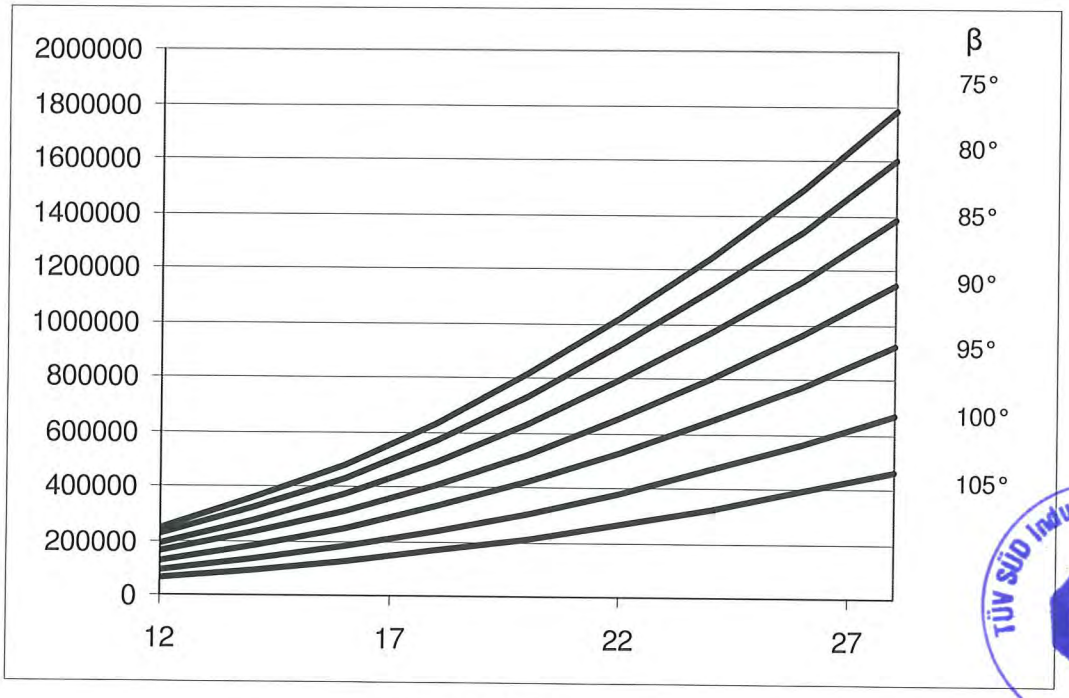
09. Sep. 2013

Theme:	**Decision graphs DRAKO 250T d=6mm, 6,5mm and 8mm and their use**
Parameters:	**Traction sheave $D_T/d=33$ Deflection sheave $D_U/d=33$**
Bendings in most stressed rope zone:	
Revision status	**Rev03** Dated: : **06.09.2013**





Safety factor S_f

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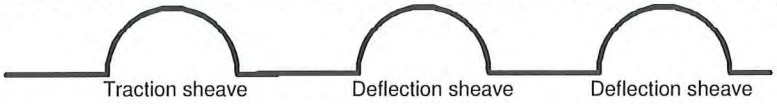
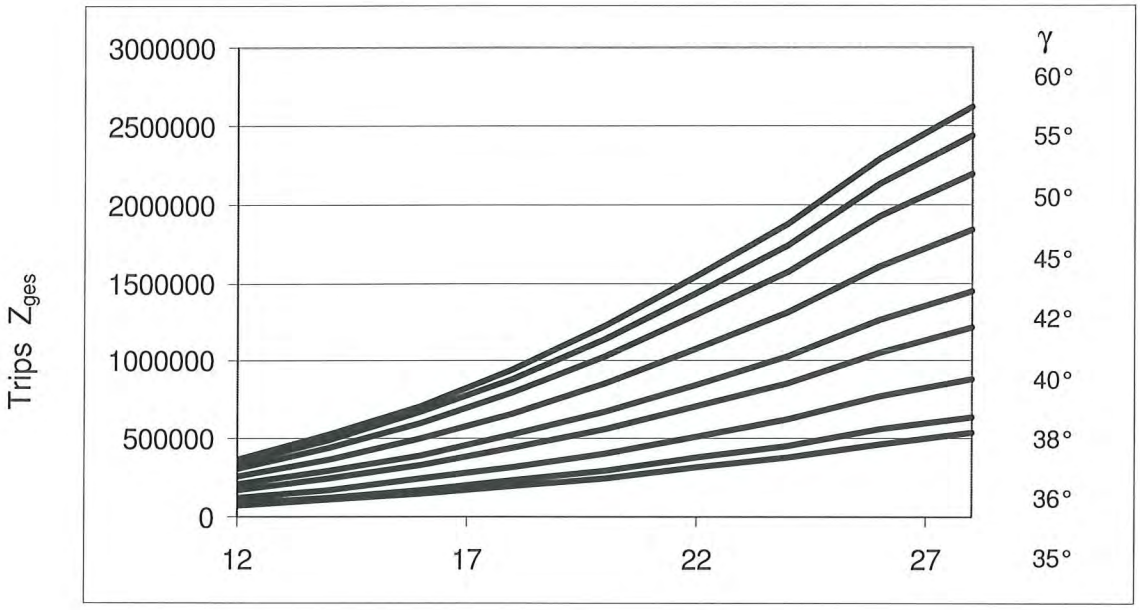
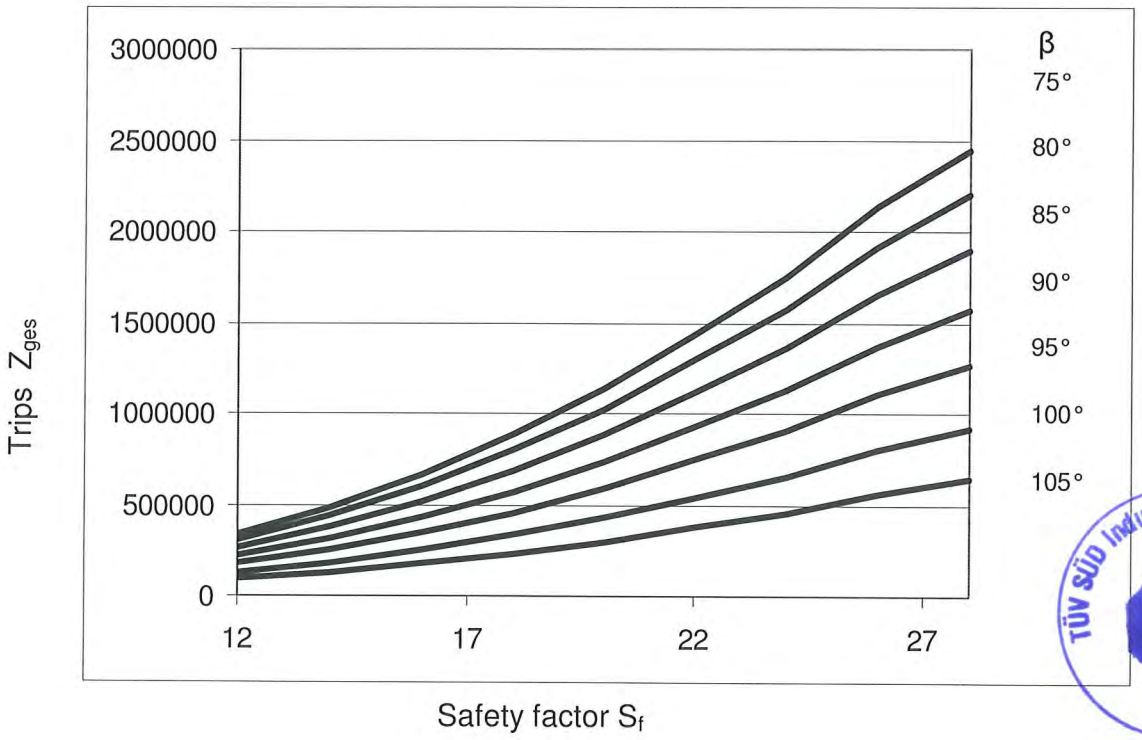
09. Sep. 2013

Theme:	**Decision graphs DRAKO 250T d=6mm, 6,5mm and 8mm and their use**
Parameters:	**Traction sheave $D_T/d=35$ Deflection sheave $D_U/d=35$**
Bendings in most stressed rope zone:	
Revision status	**Rev03** Dated: : **06.09.2013**





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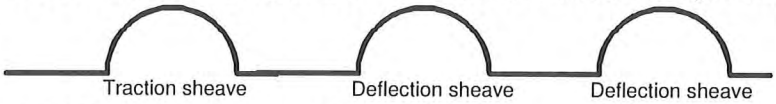
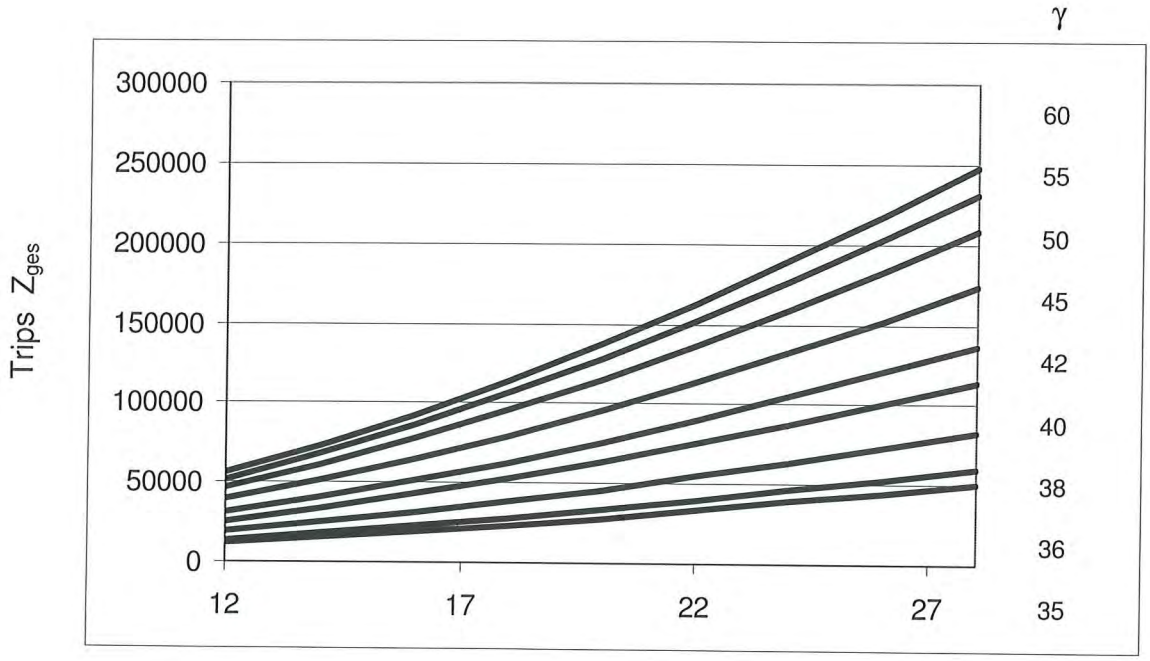
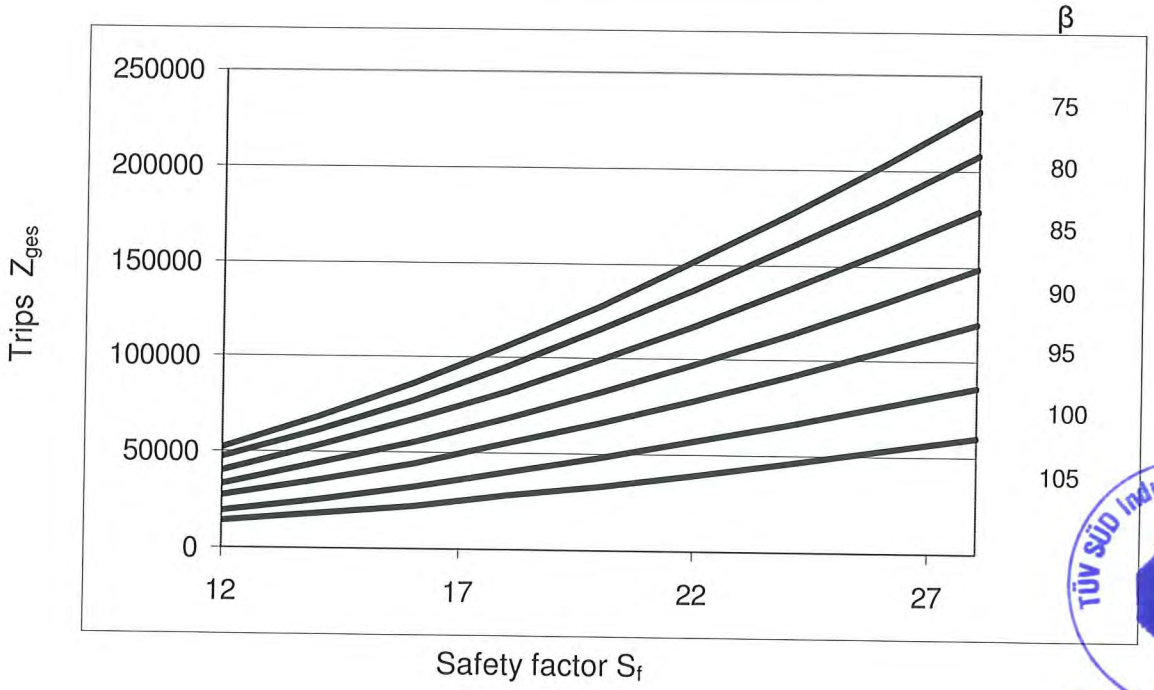
Theme:	**Decision graphs DRAKO 250T d=6mm and 8mm and their use**
Parameters:	**Traction sheave $D_T/d=20$ Deflection sheave $D_U/d=20$**
Bendings in most stressed rope zone:	
Revision status	**Rev03** Dated: : **06.09.2013**





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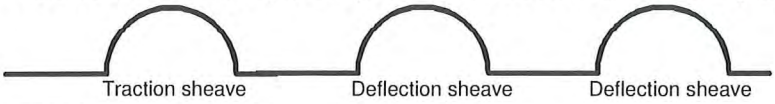
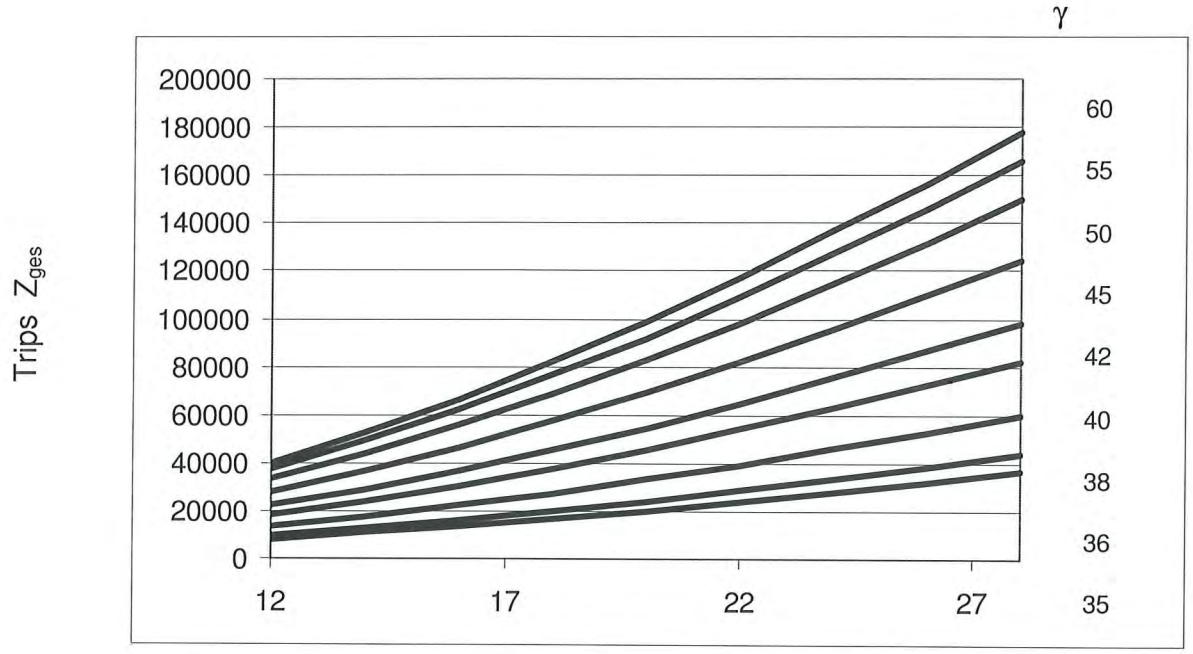
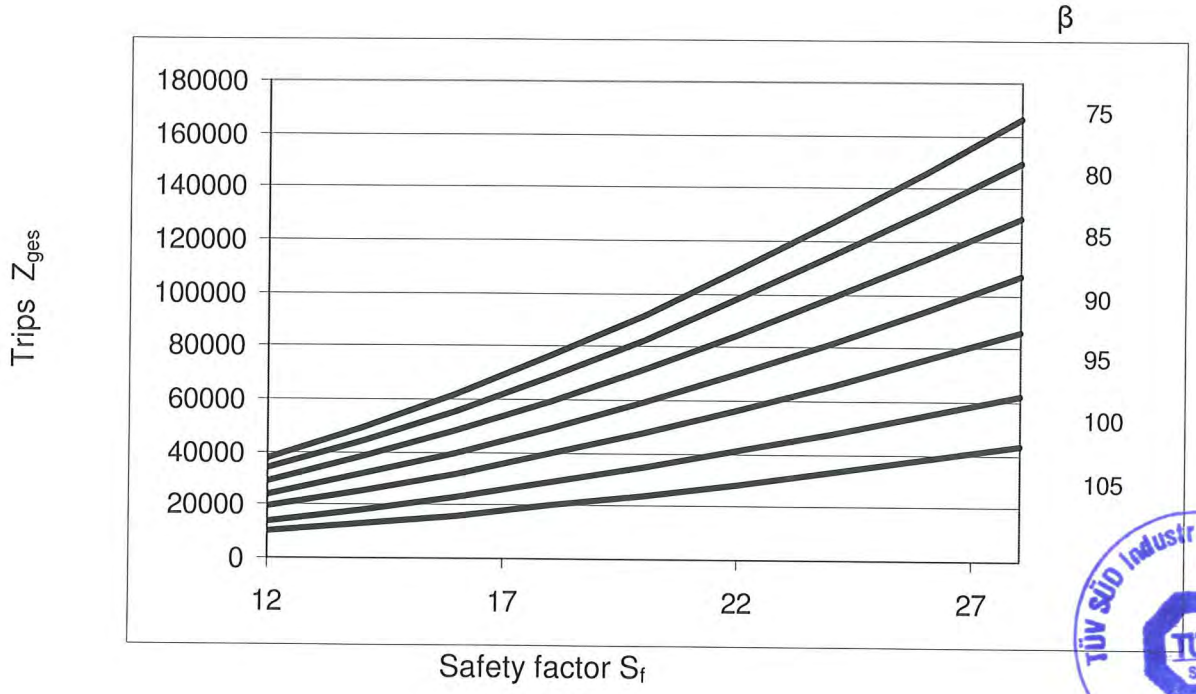
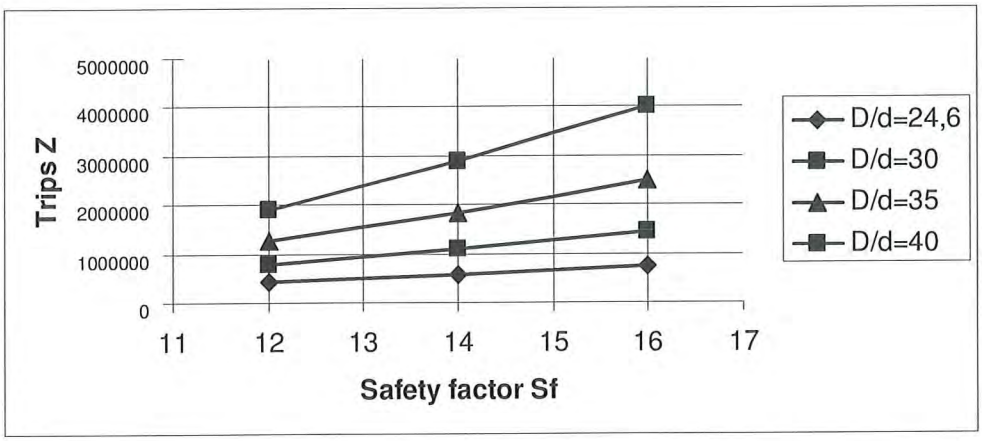
Theme:	**Decision graphs DRAKO 250T d=6,5mm and the use**
Parameters:	**Traction sheave D_T/d=18,46 Deflection sheave D_U/d=18,4620**
Bendings in most stressed rope zone:	
Revision status	**Rev03** Dated: : **06.09.2013**

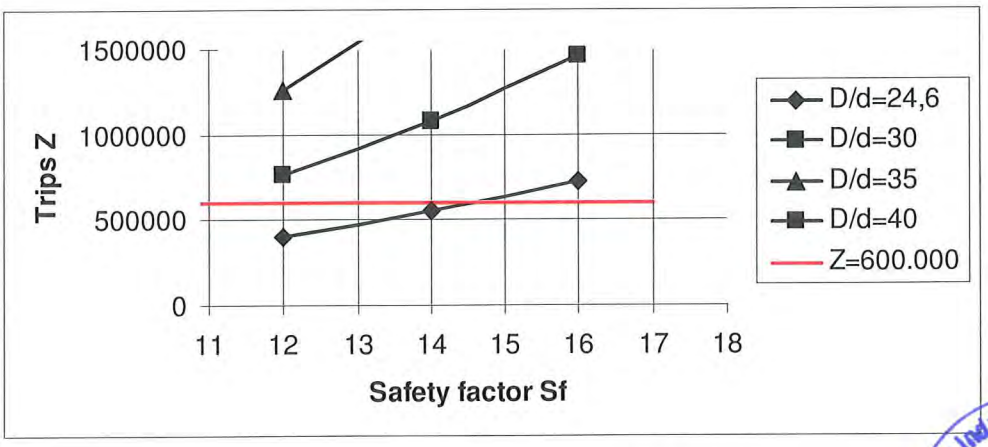




Theme:	**Decision graphs DRAKO 250T – Use in indirect hydraulic lifts**
Parameter:	**d≥6mm** **D/d≥25 bzw. D/d≥24,6 (d=6,5mm)** **S_f ≥12**
Bendings in most stressed rope zone:	
Revision status:	**Rev03** Vom: **06.09.2013**

The rules using the decision graphs for traction lifts are still valid. The following figures show examples of decision graphs for the hydraulic lifts.





Decision graphs DRAKO 250T
Run over one deflection sheave with roend groove
(use in hydraulic lifts EN81-2)

overview (above); details (below)

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The decision graphs are valid for the run over one deflection sheave. The seldom case, that the most stressed rope zone runs over two deflection sheaves has be respected by halving the trips shown above.