Knowledge Based Engineering of Hoisting Drums

Diploma thesis at the TU-Graz
Institute of Logistics Engineering

by

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Abstract

This diploma thesis describes the procedure to create an application to generate a hoisting drum on the basis of knowledge based methodologies. The calculating fundamentals, the accomplishment and the control of the results as well as the extensibility will be described in detail. Furthermore the advantages and disadvantages of these knowledge based methods will be investigated.

Inhalt

Diese Diplomarbeit beschreibt das Vorgehen zur Erstellung einer Applikation zur Generierung von Hubseiltrommeln auf der Basis von Wissens basierenden Methodologien. Beschrieben werden die benötigten Grundlagen, die Ausführung und Kontrolle der Ergebnisse, sowie die Erweiterbarkeit des Tools als Folgearbeit. Desweiteren werden die Vor- und Nachteile von solchen wissensbasierenden Methoden erörtert.

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1 Introduction

Loads have been lifted ever since man has been able to act. Hoisting loads is the oldest, if not even the most ancient task concerning the materials handling technology. Younger parts of this technology are the continuous conveying and the storage technology. The limited power of man and horse forced man already in the early ages to think of force saving devices. The “simple machines” lever and inclined plane as well as their improvements role and gore have already been existing in the antiquity. How else could have the massive bricks of the Egyptian pyramids or the stone beams of the old Greek temples been lifted. Till today these “machines” have been improved to professional cranes which are implemented in nearly every factory all over the world. To build such machines it takes a lot of constructing, manufacturing, and assembling effort. The intended purpose of this diploma thesis lies in minimizing the constructive effort of one major part of the whole crane, the hoisting drum. Due to the fact that hoisting drums in all areas of usage look similar in some way, they are perfect for a parameterized construction. The goal is to have a finished calculation, construction and manufacturing drawings by just entering a few input variables like lifting weight, lifting height, etc.

1.1 Motivation

The motivation to write a diploma thesis with the use of Knowledge Based Engineering I got out of an internship during my last summer holidays. There I had to investigate a lot in this area of expertise and really got impressed about what kind of possibilities there are. It was kind of a fortunate coincidence that the first diploma thesis that I was offered was about KBE and thereby I didn’t have to think twice if I should take it or not.

1.2 Research question

The research question of this task is, if it is possible to create a Knowledge Based Engineering construct, based on programming, technical calculations, database enquiries, technical 3D and 2D drawings, for hoisting drums with the tools available. To define it more specifically, the problem does not include to criticize, modify or even find new approaches to the existing calculating methods as well as validating them via complex computational methods.

1.3 The client, voestalpine Kranservice

The area of activity of voestalpine Kranservice lies in the support of cranes and hoisting devices of voestalpine Stahl Gmbh and other external companies in the area of Linz and surroundings. The field of application and expert knowledge reaches from simple slewing cranes to heavy – duty – cranes with lifting weights up to 250 tons. The division has over fifty specialized staff members working in dayshift as well as around the clock.

Thereby I specially want to thank Mr. Martin Schuhbauer for initiating the whole project, Mr. Peter Schumi and Mr. Roland Stiller to approve this scientific work as well as the staff members of the divisions B4I and B4M, Mr. Andreas Platzer, Mr. Lothar Weiß, Mr. Anton Steiner, Mr. Anton Galer, Mr. Helmut Kitzmüller, Mr. Thomas Nairz, Mr. Thomas Reininger, Mr. Christoph Ullman, Mr. Erwin Grabinger and Mr. Jürgen Kaineder for their special expertise and help and last but not least Mr. Christian Landschützer for supervising the project on behalf of the University.

2 Problemanalysis

2.1 Initial situation

In average, every year the division voestalpine Kranservice gets the order to design about five different hoisting drums. These drums are usually not intended for new cranes, but to repair or replace old cranes where the drums are worn out. The majority of the cranes that have to be repaired have a load carrying potential of about forty tons and the drum type of these is usually double, with outside drum clamping and one parallel cable. Although these drums somehow always look the same, it is kind of an annoying work for the design engineer to create them.

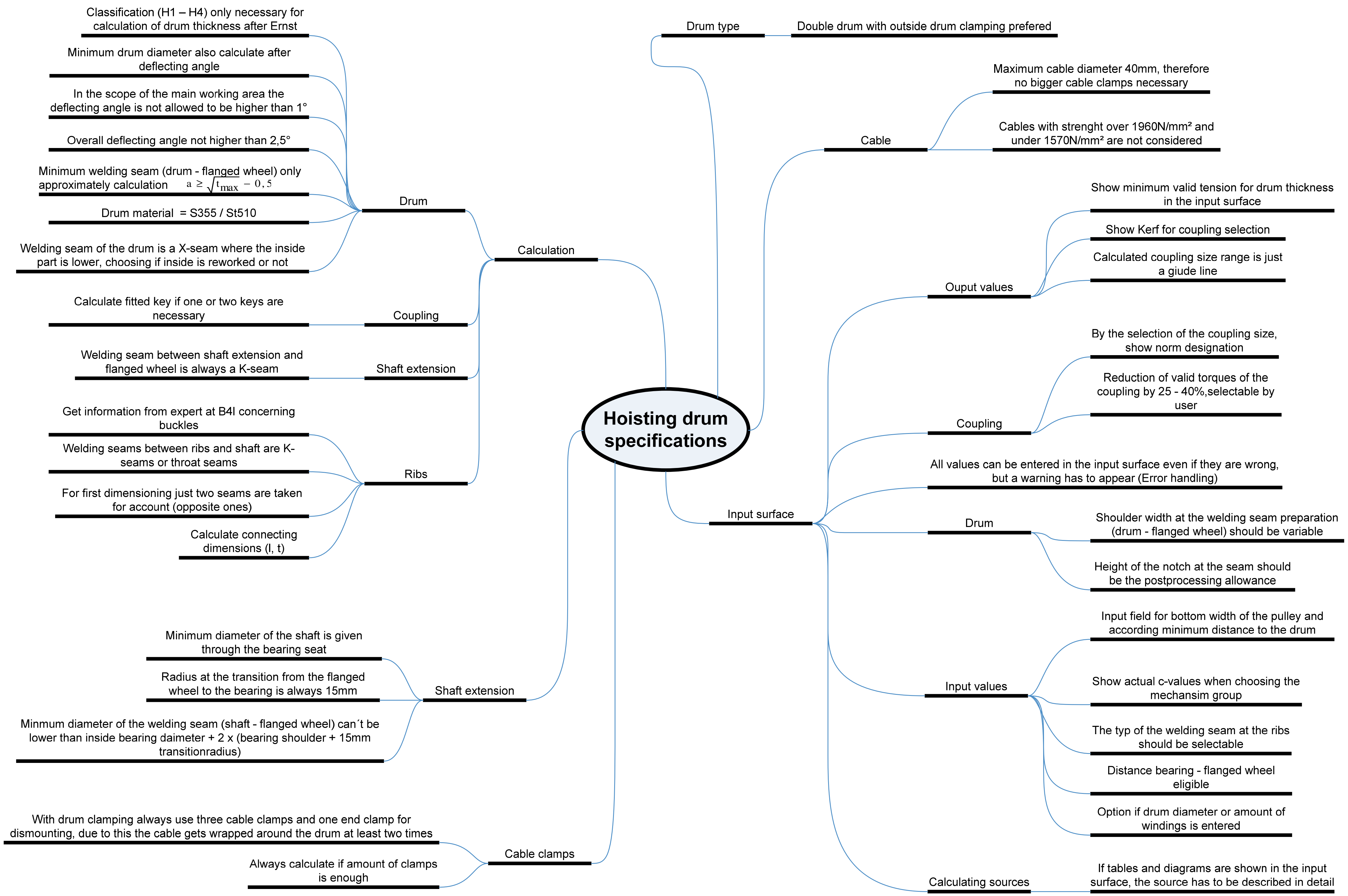
But this is not the only problem, also the constructing effort to create such a drum is about sixty hours of work which could be more efficiently used elsewhere.

Also when I looked over some past calculations for hoisting drums which have already been installed in the factory, I found some minor mistakes which for example shorten the lifetime of the coupling considerably.

Another task formulation was to consider other calculation methods for hoisting drums. For example the drum thickness has always been calculated according to Ernst (Ernst, 1973) in the last few years, but due to some external manufacturers who calculate the thickness according to Scheffler (Scheffler, 1994), this calculation method also had to be implemented as well as the calculation for the cable diameter according to CEN/TS 13001 – 3.

Another thing that was taken under consideration again was the deflecting angle of the cable to the drum, which had been left out of consideration in the last few years.

2.2 Task formulation and specifications of the hoisting drum



Picture 2-1: Mindmap of the hoisting drum specifications

In order to fix the specifications of the project, the task was formulated thoroughly. The diagram above shows all requirements which are split into the different areas of their application.

2.3 What is a Knowledge Based Engineering (KBE) system

After some reading in different books this definition is the one that fits the most concerning this diploma thesis.

"A KBE (Knowledge Based Engineering) System can be considered as a special kind of Knowledge Based System endowed with advanced data processing and CAD (Computer Aided Design) capabilities. Similarly to Knowledge Based Systems, KBE systems are able to store and reuse the knowledge of experts to solve problems. However they target the field of engineering, where solving problems by reasoning must be supplemented with analyses and computations. On top of that, the field of design engineering comes with the challenges of geometry manipulation and product configuration. In this sense, KBE is a technology able to merge the capabilities of conventional Knowledge Based Systems with those of computer aided analysis and design systems (CAE and CAD systems).

KBE Systems allow people to write dedicated programs (called KBE applications) that can perform complex and specific engineering activities more efficiently and effectively than engineers can achieve.

For example, it often takes a team of design engineers many weeks to design a complex component including the generation of geometry and the associated analysis process. With the help of a dedicated KBE application, a single engineer could achieve this same task in just a few days. The resulting savings on manpower, costs and time can be substantial. All of the time normally "wasted" by designers in lengthy and repetitive tasks can instead be dedicated to creativity and innovation. This enhances worker satisfaction and product quality.

The main use of KBE is currently to support and improve the design of complex (mechanical) systems. It is not by chance then that aircraft and car manufacturers are the main users of KBE technology." (Milton, 2008)

Another definition is stated by Saurina:

„From the very first practical deployment of software applications, some knowledge elements attempted tob e introduced, either in form of selection criteria, solving formulas and equations, etc. More or less in parallel with such approach, the basis for the so – called "Intelligent CAD" as well as Expert Systems, have been developed.

In the firsdt case, the natural idea is just adding "primitive functions" to the CAD software, so that the reproduction of common geometric elementsas for instance screws, can be automated. The next step, which triggered an actual revolution in such packages, is the parametric modeling approach; in this case, instead of building heavy libraries containing objects somehow similar, leads to a basic element with the possibility to change its relative dimensions through variable relationships.

This paradigm enables a pool of pre-created geometries, which can be adapted to every new specifications and constraints of a design, simply modifying a few parameters, leading to impressive savings on project time. On top of these functions, some other possibilities can be added, as selfcorrection, automated align-

ment, closing and trimming of curves and surfaces, automatic intersection finding, etc. The systematic use of these features allows a first abstraction level from the drawing fact itself, so that a deeper concentration can be devoted to the design process.

The Expert Systems introduced a new dimension, building a catalog of knowledge rules each one of a pretty simple formulation. This enables an actual capture of best practices and regulations, as well as simple calculations, and basically, the validation of the design accordingly. So, uncontrolled mistakes can be prevented, as well as avoiding the presentation of a project eventually violating the current applicable legislation.

Basically, this approach uses an inference engine evaluating a previously generated project against a set of rules, generating a deviation list, which can be used in practice to correct manually the original project. The rules themselves can be updated regularly, but somehow it's a passive system; and in the best case, a defensive one, as a previous manual generation of the project is required." (Saurina, 2006)

2.3.1 What are the reasons for using KBE

The most important reason for using KBE might be the cost saving potential in the meaning of saving engineering time. Numerous examples can be told by different companies which started using KBE. Some of them told by Stokes:

- *"Textron Aerostructures reduced the lead – time of a tooling application by 73%;*
- *Jaguar cars reduced the design time for an inner bonnet from 8 weeks to 20 minutes;*
- *British Aerospace reduced the design time of a wing box from 8000 hours to 10 hours;"* (Stokes, 2001)

Other examples given by Vermeulen:

- "*Design of a windscreen wiper system from weeks to minutes;*
- *Optimisation of an airfoil shape from 2 months to 4 days;*
- *Design of a compressor from 10 days to 1."* (Vermeulen, 2007)

Another reason is to avoid mistakes, weather if they are minor or not. These mistakes range from simple transcribing errors when calculating complex mathematical models, to selecting the wrong coupling size out of catalogues.

The third reason is to preserve knowledge. Best expressed by Saurina:

"The main asset a company have is knowledge, which belongs to its members and employees. Knowledge is a complex concept, as it includes not just theories, methods and rules, but also –and of the utmost importance – the mental processes themselves, thus developing creativity." (Saurina, 2006)

To have an easier design process is the next reason. The design engineer just has to enter a few main parameters instead of hundreds of variables. This not only saves time again, but also prevents errors from being made.

The last main reason would be to use the time that is saved, to encourage innovations and new ideas (Not depending if it is for the same project or any other).

2.3.2 How to develop a KBE application

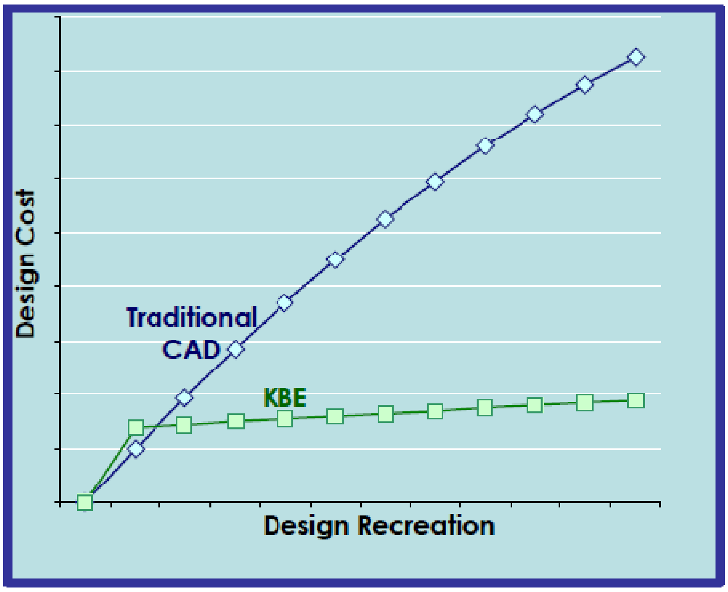
In the early times when the first KBE applications were developed there was no exact system behind and the success of the project was just depending on the people that were involved. In the 1990's the first methodology came up, the so called MOKA approach (Methodology and tools Oriented to KBE Applications). This methodology splits the development of a new KBE application into eight phases:

1. Identify: The necessary knowledge requirements must be identified. Thereby possible knowledge sources, suitable elicitation tools and techniques and proper representation methods have to be found. After this resources have to be raised and the required time estimated.
2. Justify: In order to execute the project the management has to approve it.
3. Capture: Collecting the knowledge needed either from databases, books, catalogues or from exports in oral from. After this the knowledge has to be cleaned from informal and vague content such as of the spoken word.
4. Formalize: The knowledge has then to be brought in a consistent, formal, neutral form, checked for inconsistencies and if necessary by another iteration of the capturing phase corrected.
5. Package: Retrieve the previously gained knowledge and translate (Manually or automatically) it into the form the KBE system is based on. After the changes have been done, the translation has to be checked thoroughly for any mistakes that could have happened by carelessness or inadvertently.
6. Distribute: Sending the package to all the potential users that could benefit from it.
7. Introduce: Make sure that every user who later on has to work with the program gets a thorough introduction.
8. Use: After the whole system is introduced, the real benefit of the project can be harvested which is considered as the support of the engineering activity.

2.3.3 Possibilities with KBE

KBE is not only used to just calculate one type of model (e.g. one type of screw), it is also able to generate different kinds of it by giving the user the possibility to choose the design. By this means every feature can be included or excluded from the original design. For example for a test cell for car engines different possibilities of fire extinguishing systems exist and the customer who orders such a cell suddenly, in a later stage of the project, wants to change from one to the other. For the according design engineer this would mean hours of work done for nothing and again hours of work to do for the new system. But not only the time is an important factor also the money that is connected with it. This change might cost the customer many thousands of Euros (See Picture 2-2). With a KBE application the change just takes a mouse – click at the right selection button and no further costs are involved. This thinking is best stated in a paper by the Society of Automotive Engineers, Inc.:

"A viable KBE system in the 21st century must provide users with a dynamic modeling feedback loop in an environment favorable to both exploration and experimentation, supplying various approaches for engineering a given set of artifacts. The fundamental properties of a KBE system must include automatic caching and dependency tracking for the scalable runtime performance of large models, minimal source code volume, and efficient and rapid tools for model development and debugging. And, not least, it must complement existing CAD systems."(Dave Cooper, 2008)



Picture 2-2: Comparing the costs with and without KBE

By this means different kind of hoisting drums have been implemented into the KBE application. The possibilities to select are:

1. Double or single drum
2. Drum or flanged wheel clamping
3. Outside or inside clamping (If drum type is double)
4. Couplingsided or shaftsided clamping (If drum type is single)
5. Amount of parallel cables (Two parallel cables only possible with on drum clamping)

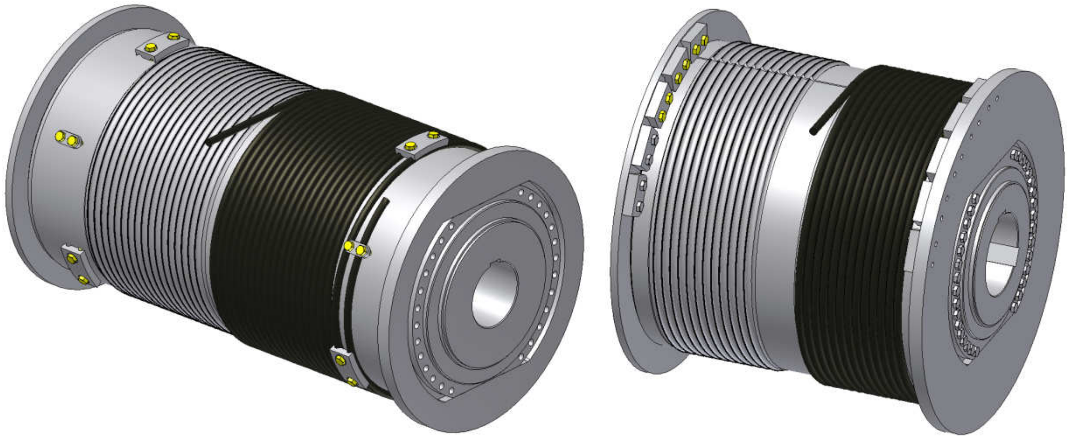
Be aware that the following pictures are not all in the same scale.

2.3.3.1 Double or single drum

Picture 2-3: Double and single drum

On the double drum only one cable is drawn in, so that the cable grooves are visible. The clamping type as well as the amount of parallel cables is the same.

2.3.3.2 Drum or flanged wheel clamping



Picture 2-4: Drum and flanged wheel clamping

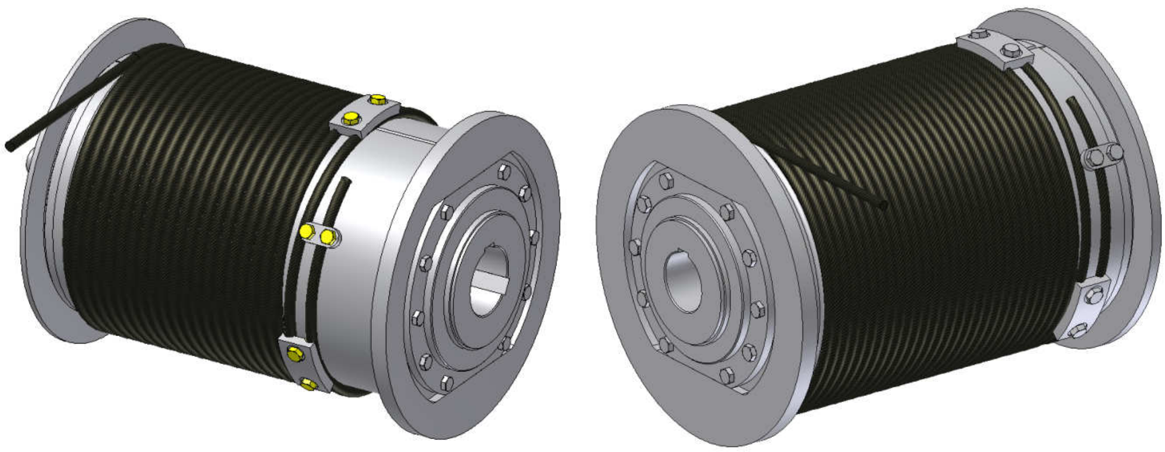
Here the difference lies in the type of clamping. On the drum clamping is the standard construction. A reason to change it would be that the overall length of the hoisting drum is getting to long and t doesn't fit into the mount anymore. The flanged wheel clamping needs less space and therefore is a possible alternative.

2.3.3.3 Outside or inside clamping (If drum type is double)

Picture 2-5: Outside and inside clamping (Double drum)

A reason to change from outside to inside clamping could be that the deflecting angle of the cable is getting to high and the only way to prevent this is by changing the position of the clamps.

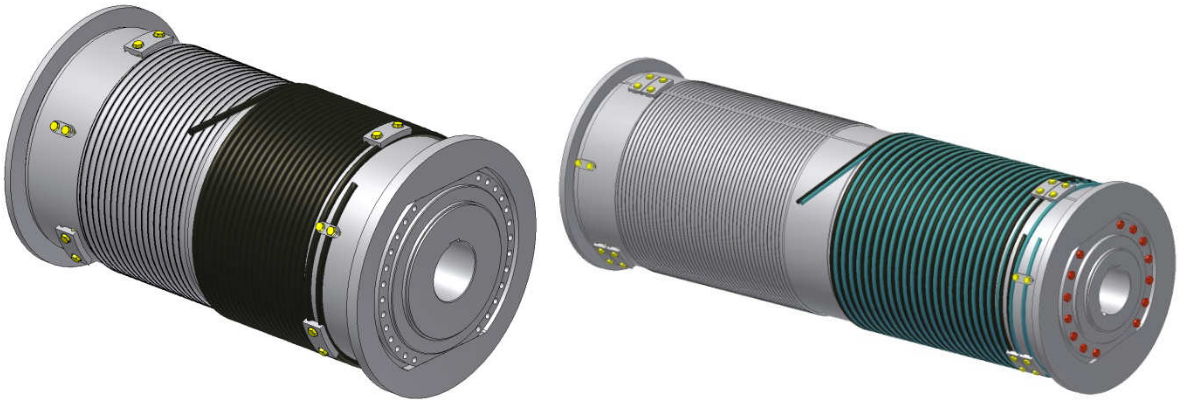
2.3.3.4 Couplingsided or shaftsided clamping (If drum type is single)



Picture 2-6: Coupling sided and shaft sided clamping (Single drum)

This just depends on the mounting of the hoisting drum on the crane trolley. Usually two single drums are mounted next to each other so that the couplings are in the middle and thereby they act similar to a double drum but with a bigger distance of the cables (Comparable with outside and inside clamping).

2.3.3.5 Amount of parallel cables (Two parallel cables only possible with drum clamping)



Picture 2-7: Drums with one or two parallel cables

Hoisting drums with two parallel cables are a special form. At the voestalpine Stahl Gmbh they are only implemented at casting cranes, where the second cable has the task of securing the load if the first cable tears off.

Nearly all of the previous mentioned options can be combined with each other. For further details see chapter 3.2.1 Choosing the type of drum on page 43.

2.3.3.6 Extensibility of the application

The features that are described in the chapters above are of course not the end of possibilities there are. In chapter 6.1Future development on page 127 the further potential of the application are described.

2.3.4 Conclusion of KBE

If companies want to stay competitive in the future it is indispensable for them to change the "old ways" of designing components and devices by introducing KBE applications. Especially manufacturers of standard parts, where there is not much innovative thinking behind, are the first ones who will be affected. Their chance lies in standardizing these components, or even improving them by using KBE. The onetime costs for implementing such an application might be higher, but the benefits afterwards are brought in incomparably fast (See chapter 2.3.1 What are the reasons for using KBE on page 6).

"The over – arching goal of KBE in this century is to enable the power of modern computing to come together with the creativity in the mind of an engineer, and to do so in the most effective ways possible. Over the years, this vision has taken on many forms, but certain recurrent themes have emerged as the "keys to success" for a durable KBE presence. Those keys at bedrock are: simplicity of the language syntax, ease of use, and a commitment to build on existing technology and Industry Standards wherever possible."(Dave Cooper, 2008)

2.4 Tools and supplies for work

For managing the task ahead some tools and calculation fundamentals were necessary. In the following chapters the working equipment used will be described in detail.

2.4.1 Software

Due to the fact that the work of this diploma thesis is based on computational means, different software programs were needed. Those were Autodesk® Inventor® with the features components, assembly and iLogic; Microsoft© Excel for the purpose of programming, table calculating, usage as a database and report generation.

2.4.1.1 Inventor®

"Autodesk® Inventor® products offer a comprehensive, flexible set of software for 3D mechanical design, product simulation, tooling creation, and design communication." (Autodesk2010)

Although Inventor is a very easy to learn CAD drawing program, it has one minor disadvantage when compared with similar software (e.g., CATIA, Solid Works...). The downside is that most of the other programs already have KBE software included or at least there are other companies who provide it for them, but not in the case of Inventor.

2.4.1.1.1 Components

This basic feature, which is included in every standard CAD drawing program, allows you to build and model 3D objects. The functions used for modeling a hoisting drum were: "Draft", "Extrusion", "Rotation", "Windings", "Duplicate", "Mirror", "Round alignment", "Rectangular alignment" and variations of them. This feature also includes the key function "Parameters…." which is necessary to connect the dimensions with the calculated parameters.

2.4.1.1.2 Assembly

In order to build a whole hoisting drum, assembling of the single premade components is necessary. The functions used for assembling these parts were: "Align", "Round alignment", "Rectangular alignment", "Connect", "Merge" and variations of them.

2.4.1.1.3 iLogic

iLogic is a subprogram of Inventor® that is used to write rules which suppress or unsuppress parts, features of parts (like boreholes), constraints or to trigger events. In this case, special rules, which use simple if and while queries, were setup to model the drum according to the parameters: “Single or double drum”, “Flanged wheel or drum clamping”, “One or two parallel cables” and “Inside or outside clamping”. During the work with this program there was one issue which had to be overcome. The problem was that iLogic doesn’t refresh rules that change parts while you are working in assembly (What you do if you open the file “Seiltrommel.iam”). So all the rules had to be written in assembly and thereby connected to the single part files.

2.4.1.2 Excel

Microsoft© Excel is usually designed to create table calculations and to write small macros. In this case it was used to write a program which lets you generate a whole hoisting drum. For this the sheets were used to handover the parameters to the drawing program, secondly as a database for the different kinds of couplings and cables etc. thirdly for calculating purposes like forces and torques etc. and fourthly to generate a printable version of the calculation for documentation purposes. All of this is managed by a VBA code.

2.4.1.2.1 Parameter handover

In order to connect the Excel file to the 3D – drawing program, all necessary values (e.g., diameters, lengths, welding seam type….) are copied into the Excel sheet “Tabelle1” (Table1).

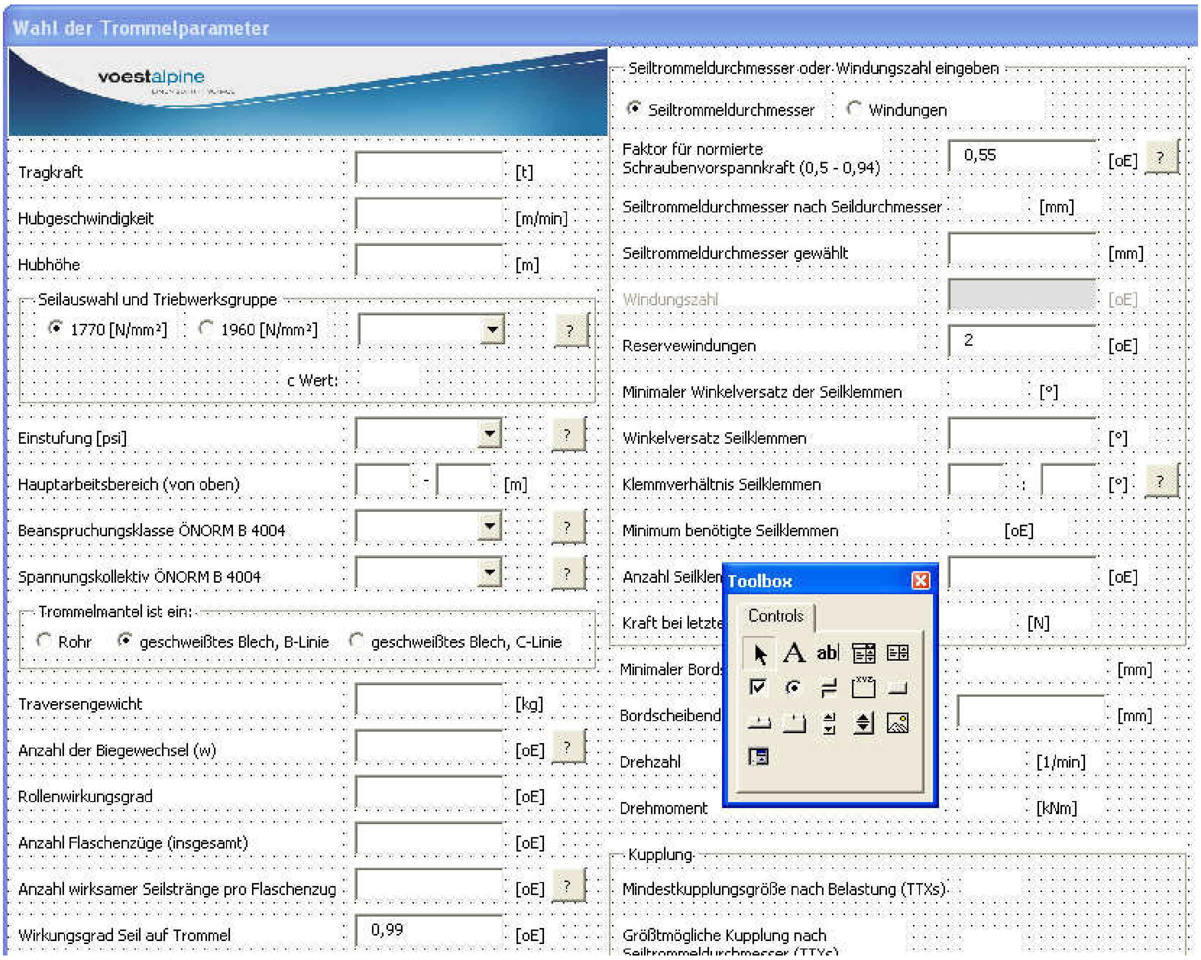
BG	BH	BI	BJ	BK	BL	BM	BN	BO	BP	BQ	BR	BS
r_sr	h_sr	a_sr	Windungen	D_bs	$D_{schulter}$_bs	$B_{schulter}$_bs	D_Trommel	Lagerabst_wz	Lagerbreite_wz	d_{Lager}_wz	D_{Lager}_wz	r_{Lager}_wz
0,8	10,5	3,5	15,00	1400,00	1146	3,00	1200,00	110,00	37	75	87	2,00
58	59	60	61	60	64	65	66	67	68	69	70	71
Seilrillen				Bordscheibe			Trommel	Wellenzapfen				

Picture 2-8: Excel sheet "Tabelle1"

Picture 2-8 shows a part of the sheet. It contains 105 different parameters which will be described in more detail in chapter 3.3.1 Handover of the parameters on page 74. Inventor reads the parameters in that way, so that the first row contains the name of the parameter and the second row the value. The formatting serves just the purpose of clearness.

2.4.1.2.2 Visual Basic for Applications

The idea behind using VBA was that it is a simple programming language with the capability to make input masks, which is already included in Excel. The features used were: Textboxes, Combo boxes, Option buttons, Command buttons, Image fields and Labels. Textboxes were used for the input parameters like lifting weight, lifting height etc. Combo boxes were filled with given data like coupling sizes, cable diameters etc. which can be selected afterwards. Image fields were just added for explaining purposes, like the position of the key of the coupling. Labels were used to explain the input variables, and give feedback like valid tensions, minimum and maximum coupling sizes etc. and for options which have just two or three possibilities, Option buttons were applied. Picture 2-9 shows a part of the input mask „ufmParametereingabe" ("ufm" is short for user form; parameter input), in VBA – style, where the main parameters are entered.



Picture 2-9: Programming in VBA

2.4.1.2.3 Table calculation

In order to calculate cable forces, deflecting angles, clamping forces, torque and so on, the feature of table calculating was used. In the sheet “Berechnung” (Calculation) all the input values are saved and instantaneously the output values are calculated. Some of them are then shown in a label on the input mask for information. Picture 2-10 shows a part of this sheet.

Seilberechnung		
η_F	0,932731109	
F_{Sl}	72704,4947	[N]
c*	0,097052442	
$d_{min\ berechnet}$	26,16899818	[mm]
F_{Sltat}	72729,23186	[N]

Seiltrommeldurchmessers nach Seildurchmesser		
$D_{Seiltrommel}$	627,2	[mm]

Seilrollendurchmesser nach Seildurchmesser		
$D_{Seilrolle}$	784	[mm]

Ausgleichsrollendurchmesser nach Seildurchm		
$D_{Ausgleichsrolle}$	448	[mm]

Herstellerspeziefische Angaben		
Casar Stratoplast		
f*	0,68	
E-Modul	100000	[N/mm^2]

Seilklemmenberechnung Doppelseilklemmen		
Seilklemmenanzahl		3
α_{Seil}	12,56637061	[rad]

zul. Normwerte		
Passfeder Flächenpressung		
$p_{grenz,max}$	408,2792631	[N/mm²]
$R_{P0,2}$ Ck45	355	[N/mm²]
zul. Trommelspannung		
σ_{zul}	198,00	[N/mm²]
zul. Spannung für Ringschweißnaht		
$\sigma_{zul\ Ring/Rippe\ D\ w}$	44,5	[N/mm²]
$\sigma_{zul\ Rippe\ B\ w}$	59,4	[N/mm²]
zul. Wellenzapfenspg.		S355
σ_{zulDIN}	53	[N/mm²]
zul. Schweißnahtspg. Wellenzapfen		
$\sigma_{E\text{-}Linie\ wechselnd}$	31,8	[N/mm²]
zul. Schweißnahtspg. Stirnwand		
σ_{bstzul}	19,1	[N/mm²]
zul. Trommelstirnwandspannung		
$s_{zul\ BS\ A\ w}$	105	[N/mm²]

Berechnung Ablenkwinkel		
b_{ist}	0,473104063	[°]
$\gamma_{1außen/1innenfix}$	-1,631737195	[°]

Picture 2-10: Excel sheet "Berechnung"

2.4.1.2.4 Database

Due to the fact that there is not just one cable or one coupling size but many different cable diameters and coupling sizes, their defining values had to be stored somewhere. Picture 2-11 shows a part of the sheet „Malmediekupplungen“, where the main parameters of the different coupling sizes are stored. Other sheets that contain defining values are: “Rillenabmessungen”, “Seilklemmen”, “Passfeder”, “Pendelrollenlager”, “Triebwerksgruppen”, “CEN 13001”, “zul. Spannungen” and „Scheffler“.

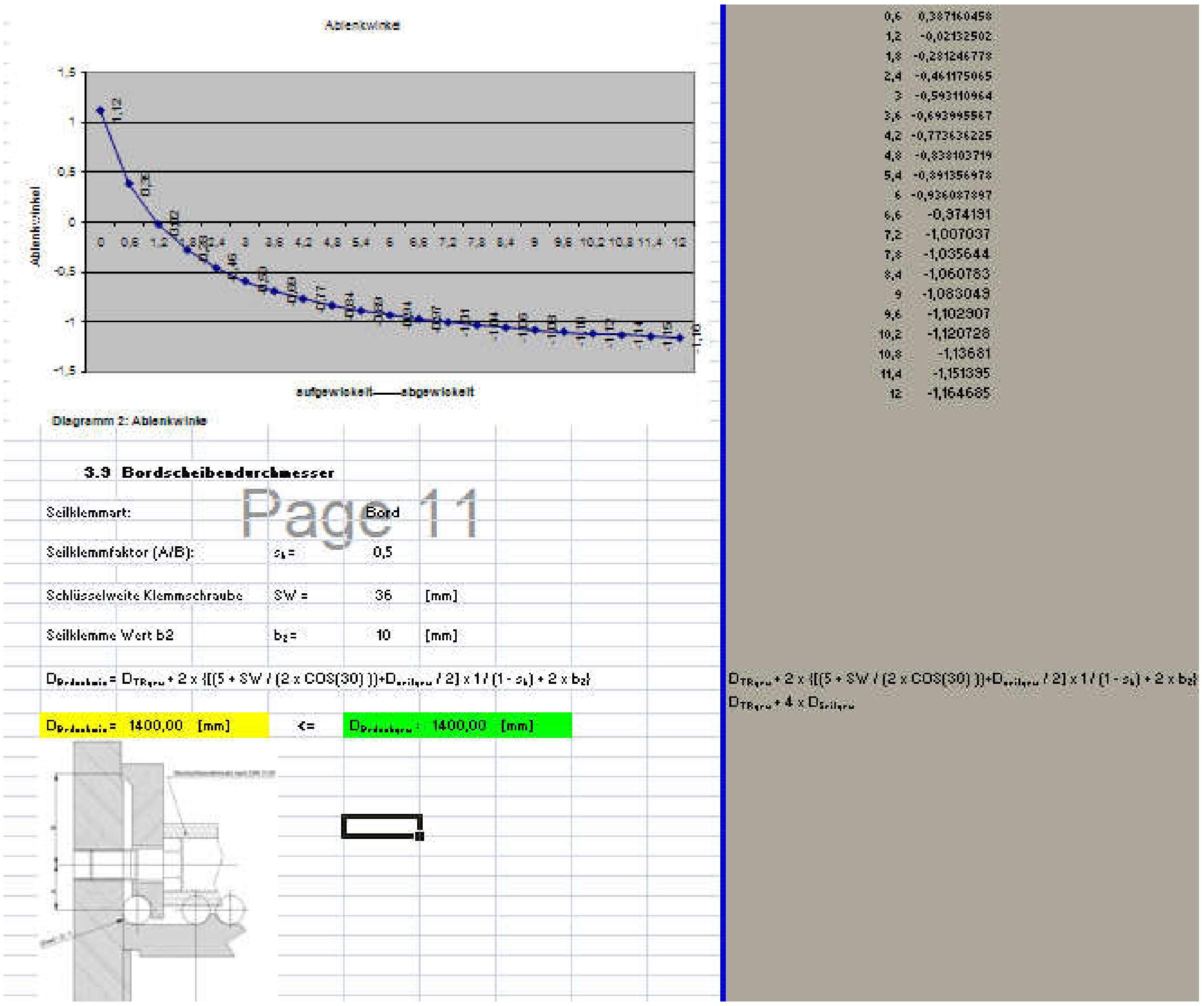
Part Number	L	e2	e1	a1	h2	h1	sh9	k1	r	n	d welle	d1	d2	d3	d4
0,25	95,00	4,80	42,00	12,00	31,20	16,00	220,00	220,00	2,50	10,00	65,00	95,00	95,00	159,00	
0,50	100,00	4,80	42,00	12,00	31,20	16,00	250,00	250,00	2,50	10,00	75,00	110,00	110,00	179,00	
0,75	110,00	4,80	42,00	12,00	32,20	17,00	280,00	280,00	2,50	10,00	86,00	125,00	125,00	199,00	
1,00	125,00	4,80	45,00	15,00	32,20	17,00	300,00	300,00	2,50	10,00	96,00	140,00	140,00	219,00	
1,30	130,00	4,70	45,00	15,00	34,30	19,00	320,00	320,00	2,50	10,00	110,00	160,00	160,00	239,00	
1,60	145,00	4,70	45,00	15,00	34,30	19,00	340,00	340,00	2,50	10,00	124,00	180,00	180,00	259,00	
2,00	170,00	3,70	45,00	15,00	36,80	20,50	360,00	360,00	2,50	10,00	137,00	200,00	200,00	279,00	
3,00	175,00	4,70	45,00	15,00	40,20	24,90	380,00	380,00	2,50	10,00	151,00	220,00	220,00	309,00	
4,00	185,00	8,70	60,00	20,00	39,20	20,90	400,00	400,00	2,50	10,00	179,00	260,00	260,00	339,00	
5,00	220,00	7,00	60,00	20,00	42,30	22,30	460,00	460,00	2,50	10,00	206,00	300,00	300,00	399,00	
6,00	240,00	7,00	60,00	20,00	49,00	29,00	500,00	500,00	2,50	10,00	213,00	310,00	310,00	419,00	
10,00	260,00	7,00	60,00	20,00	52,50	32,50	530,00	530,00	2,50	14,00	200,00	350,00	350,00	449,00	
15,00	315,00	7,00	65,00	25,00	43,00	30,00	580,00	600,00	2,50	14,00	210,00	410,00	438,00	529,00	
21,00	330,00	6,00	65,00	25,00	63,00	35,00	590,00	615,00	4,00	26,00	296,00	430,00	460,00	544,00	
26,00	350,00	6,00	65,00	25,00	63,00	35,00	600,00	630,00	4,00	26,00	303,00	440,00	475,00	559,00	
34,00	380,00	10,00	81,00	35,00	59,00	38,00	640,00	660,00	4,00	26,00	324,00	470,00	507,00	599,00	
42,00	410,00	10,00	81,00	35,00	59,00	38,00	700,00	730,00	4,00	26,00	365,00	530,00	571,00	669,00	
62,00	450,00	10,00	81,00	35,00	61,00	40,00	760,00	800,00	4,00	26,00	413,00	600,00	635,00	729,00	
82,00	500,00	6,00	86,00	40,00	62,00	50,00	830,00	875,00	4,00	32,00	450,00	650,00	698,00	793,00	
92,00	500,00	6,00	86,00	40,00	62,00	50,00	900,00	945,00	4,00	32,00	485,00	699,00	730,00	829,00	
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	

Tabelle1 | Berechnung | Hauptteil | Rillenabmessungen | Seilklemmen | Passfeder | Malmediekupplungen | P

Picture 2-11: Excel sheet "Malmediekupplungen"

2.4.1.2.5 Report generation

In order to make a valid document out of the calculation which can be stored or printed afterwards, a report had to be generated. This report formats itself according to the kind of drum chosen. (e.g., pictures and formulas are changed or certain parts of the calculation are made invisible) Picture 2-12 shows a part of the sheet "Hauptteil" (Main part), which contains the printable version of the calculation.



Picture 2-12: Excel sheet "Hauptteil"

2.4.2 Calculating fundamentals

Calculating hoisting drums is nothing new and there are many different approaches how to do so. In the next few chapters the used formulas will be described and explained.

2.4.2.1 DIN 15020 – 1, calculating the rope drive

In this standard for lifting appliances, basic principles for cable reeling components, computation and design are described. When calculating the rope drive the following influences have to be accounted for:

1. Mechanism group (German: “Triebwerksgruppe”)
2. Cable diameter
3. Diameter of the drum, deflection sheave and compensation sheave
4. Cable grooves

2.4.2.1.1 Mechanism group

The mechanical parts of cranes and lifting devices should be classified (mechanism group) according to their functional mode, so that the operational time is adequately considered. The classification happens due to the average running time of the rope drive and the load spectrum. See Picture 8-1 on page 139.

2.4.2.1.2 Cable diameter

Due to the classification and the wire strength, the factor c is found (Picture 8-2 on page 140). In this case the selectable wire strengths are 1770 $[\frac{N}{mm^2}]$ and 1960 $[\frac{N}{mm^2}]$. With this value and the load of a single cable the minimum cable diameter can be calculated by:

$$\boldsymbol{d_{min} = c \times \sqrt{S}} \qquad \text{Eq: 2-1}$$

d_{min}	Minimum cable diameter $[mm]$
S	Cable load $[N]$
c	Factor out of the mechanism group and the cable strength $[\frac{mm}{\sqrt{N}}]$

2.4.2.1.3 Drum, deflection sheave and compensation sheave diameter

The diameter of the hoisting drum, deflection sheave and compensation sheave (Referred to the middle of the cable) is calculated by:

$$\boldsymbol{D_{min} = h_1 \times h_2 \times d_{min}} \qquad \text{Eq: 2-2}$$

D_{min}	Minimum drum diameter $[mm]$
h_1	Factor according to Picture 8-3 on page 140, depending on the mechanism group and cable construction $[-]$
h_2	Factor according to Picture 8-4 on page 141, depending on the arrangement of the rope drive $[-]$
d_{min}	Minimum cable diameter $[mm]$

Bigger diameters affect the running time of the rope drive in a positive way.

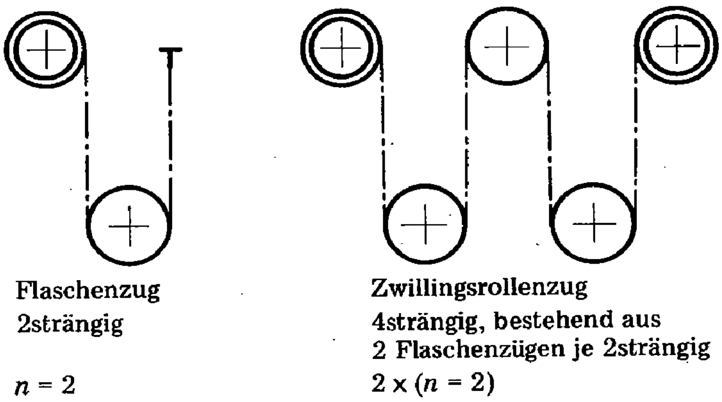
2.4.2.1.4 Efficiency factor of the pulley

The efficiency factor of the pulley (German: “Flaschenzug”) is calculated by:

$$\boldsymbol{\eta_F = \frac{1}{n} \times \frac{1-(\eta_R)^n}{1-\eta_R}} \qquad \text{Eq: 2-3}$$

η_F	Efficiency factor of the pulley
n	Amount of cable strands running on one pulley. One pulley is the sum of all cable strands and deflection sheaves for one cable which is running onto one drum.
η_R	Efficiency factor of one deflection sheave. This factor is not only depending on the bearing of the sheave but also on the ratio of the sheave diameter to the cable diameter, the construction and the lubrication of the cable. If there are no more exact values through experiments available, they have to be approximated with 0.96 for plain bearings and 0.98 for roller bearings.

Concerning the compensation sheave, no efficiency factor has to be calculated.



Picture 2-13: Definition of the amount of cable strands on one pulley

2.4.2.1.5 Cable grooves (Ratio groove radius to cable diameter)

The running time of a cable increases with decreasing pressure between the cable and the grooves. It’s thereby recommended, to adjust the groove radius to the cable diameter. The suggested mean value is calculated by:

$$\boldsymbol{r = 0,525 \times d} \qquad \text{Eq: 2-4}$$

r	groove radius
d	cable diameter

llowed deviations from this value are documented in the standard DIN 15061.

2.4.2.2 Converting the c –factor of the standard DIN 15020

It is traditional that in the different areas of crane construction the filling factor of the cable is considered when calculating the minimum cable diameter. Due to this the engineer gets smaller cable diameters by considering special cable constructions with higher filling factors. For the same reason smaller drum, deflection sheave and compensation sheave diameters are calculated (See equation $\boldsymbol{Dmin}=\boldsymbol{h_1} \times \boldsymbol{h_2} \times \boldsymbol{d_{min}}$ Eq: 2-2) which thereby also leads to smaller drum widths. By the same means the required torque and hence smaller gears and motors are necessary. Because of this, the overall weight is reduced and thereby also the load carrying construction becomes lighter.

$$\boldsymbol{c^*} = \boldsymbol{c} \times \sqrt{\frac{\boldsymbol{f}}{\boldsymbol{f^*}}} \qquad \text{Eq: 2-5}$$

c	Old c – factor $[\frac{mm}{\sqrt{N}}]$
c*	Recalculated c – factor $[\frac{mm}{\sqrt{N}}]$
f	Filling factor has the value 0.46 (DIN 15020) $[-]$
f*	Filling factor given by cable manufacturer (In this case, Casar Stratoplast; $f^* = 0{,}60$) $[-]$

$$\boldsymbol{c^*} = \boldsymbol{c} \times \sqrt{\frac{\boldsymbol{0{,}46}}{\boldsymbol{0{,}60}}}$$

$$\underline{\boldsymbol{c^*} = \boldsymbol{c} \times \boldsymbol{0{,}875}}$$

2.4.2.3 Calculating the minimum coupling size

There are two ways to select the coupling size. The first one is according to the standard SEB 666212 – 2, the second one is more specific to the coupling manufacturer (In this case, Malmedie TTXs).

The sizes that are eligible are: SG 130, SG 140, SG 185, SG 200, SG 240, SG 270, SG 315, SG 355, SG 400. Their valid torque ranges from 24000 Nm to 685000 Nm as well as their maximal radial force ranges from 38500 N to 380000 N.

2.4.2.3.1 SEB 666212 - 2

The norm calculates the factor K_{erf} with which a coupling size can be chosen according to Picture 8-5 on page 142.

$$\boldsymbol{K_{erf}} = \frac{\boldsymbol{P_{Tr}} \times \boldsymbol{C_{erf}}}{\boldsymbol{n_{Tr}}} \leq \boldsymbol{K_{zul}} \qquad \text{Eq: 2-6}$$

K_{erf}	Necessary factor to select the right coupling size $[\frac{kW}{min^{-1}}]$

P_{Tr} Necessary driving power related to the joint connection $[kW]$

C_{erf} Necessary operating factor related to the mechanism group$[-]$

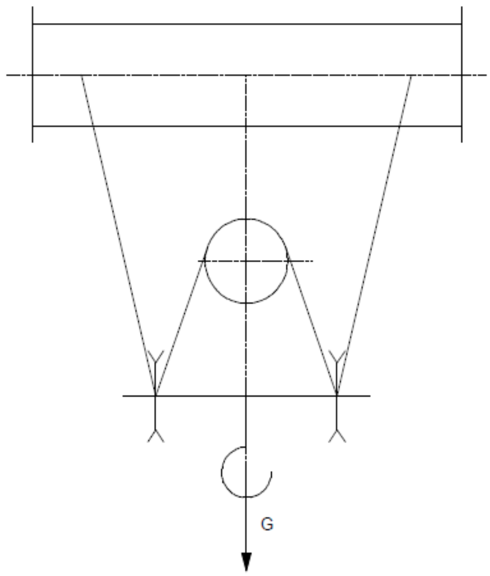
n_{Tr} Rpm of the drum $[min^{-1}]$

K_{zul} The valid values for this factor are found in Picture 8-5 on page 142. These values still have to be reduced be a factor of 25 – 40% due to 3 – shift work $[\frac{kW}{min^{-1}}]$

2.4.2.3.2 Malmedie TTXs

Malmedie uses the radial force and the torque that stresses the coupling and according to that, the coupling size is selected.

Radial force F_{max} calculated for a double drum



Picture 2-14: Radial force calculated for a double drum

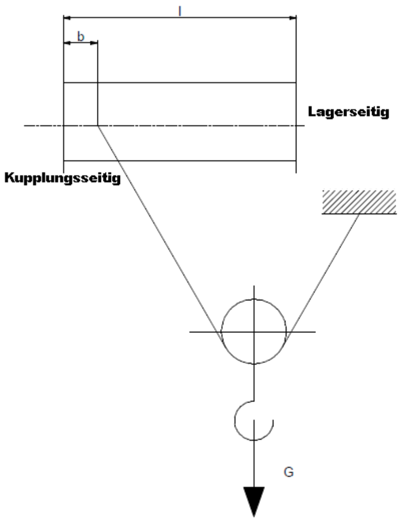
$$\boldsymbol{F_{max}} = \frac{\boldsymbol{G_{Tr}}}{\boldsymbol{2}} + \frac{\boldsymbol{W}}{\boldsymbol{2}} \quad \text{Eq: 2-7}$$

F_{max} Maximum radial force $[N]$

G_{Tr} static load on the drum $[N]$

W Own weight of the drum $[N]$

Radial force calculated for a single drum



Picture 2-15: Radial force calculated for a single drum

$$\boldsymbol{F_{max}} = \left[\boldsymbol{G_{Tr}} \times \left(\boldsymbol{1} - \frac{\boldsymbol{b}}{\boldsymbol{l}}\right)\right] + \frac{\boldsymbol{W}}{\boldsymbol{2}} \qquad \text{Eq: 2-8}$$

b	Minimum distance from the cable to the middle of the drum $[mm]$
l	Distance of the bearings $[mm]$

The thereby calculated radial force F_{max} has to be lower than the valid radial force Fr_{max} of the coupling. (Picture 8-6 on page 142)

Corrected radial force

Now, in case the maximum driving torque T_{max} is lower than the valid torque Tk_{max} of the preselected coupling, the valid radial force Fr_{max} can be increased according to:

$$\boldsymbol{Fr_{korr}} = \frac{(\boldsymbol{Tk_{max}} - \boldsymbol{T_{max}})}{\boldsymbol{C_{erf}}} + \boldsymbol{Fr_{max}} \qquad \text{Eq: 2-9}$$

T_{max}	maximum driving torque $[Nm]$
Tk_{max}	maximum valid torque according to Picture 8-6 on page 142 $[Nm]$
Fr_{max}	maximum valid radial force according to Picture 8-6 on page 142 $[N]$
C_{erf}	Necessary operating factor related to the mechanism group$[-]$

The reversed way, to increase the valid torque instead, is not allowed.

2.4.2.4 Fitted key (G. Niemann, 2001, 3.Auflage)

This is the most used shaft – hub connection, it is easy to manufacture and if it is just stressed with a constant, single sided load, the load carrying capacity is enough transmit the torque. The longitudinal force is just carried by the planes on the side of the key. The occurring pressure on the flanks is calculated by:

$$\boldsymbol{p_{max}} = \frac{\boldsymbol{T}}{\boldsymbol{r_W \times z}} \times \frac{\boldsymbol{\cos \alpha_W}}{\boldsymbol{l \times h_W}} \times \boldsymbol{k_{\varphi\beta}} \times \boldsymbol{k_1} \qquad \text{Eq: 2-10}$$

This is a standard equation which is used to calculate not only fitted keys but also splined shafts and serrated shafts. Due to this, the equation has to be modified. The parameters that change are: $\cos \alpha_W = 1$ and $r_W = \frac{d}{2}$.

T	Driving torque $[Nm]$
$l = l_{tr}$	Load carrying length $[mm]$
h_W	Is the height of the key that reaches into the shaft $[mm]$
z	Factor according to the amount of fitted keys (1: z = 1; 2: z = 2 x 0,75) $[-]$
p	Pressure on the flanks of the key $[\frac{N}{mm^2}]$
d	Diameter on which the keys are mounted onto $[mm]$
$k_{\varphi\beta}$	Considers the exactness of the connection and the wear out of the flanks according to the amount of keys (1: $k_{\varphi\beta} = 1$; 2: $k_{\varphi\beta} = 1{,}1$) $[-]$
k_1	The distributing factor is concerned with the distribution of the load along the length of the key due to the twisting of the connection (Picture 8-7 on page 143) $[-]$

This calculated pressure is now compared with the valid pressure which might be lowered due to different factors:

$$\boldsymbol{p_{grenz,max}} = \boldsymbol{f_l} \times \boldsymbol{f_s} \times \boldsymbol{R_P} \qquad \text{Eq: 2-11}$$

f_s	Support factor (For fitted keys $f_s = 1$) $[-]$
R_P key)	Insert the yield strength of the weakest component (Hub, shaft or $[\frac{N}{mm^2}]$
f_l	Factor for the amount of load peaks (The lower the amount of load peaks, the higher is the valid pressure) $[-]$

The pressure on the flanks now has to be, with a certain safety S_{FS}, under a specific limit.

$$\boldsymbol{S_{FS}} = \frac{\boldsymbol{p_{grenz,max}}}{\boldsymbol{p_{max}}} \leq \boldsymbol{S_{Fmin}} \qquad \text{Eq: 2-12}$$

The minimum safety S_{Fmin} for ductile materials lies between 1,0 and 1,3 this is because the flow limit can be exceeded on some areas of the surface of the key without affecting the function of the connection. It rather enhances the distribution of the load.

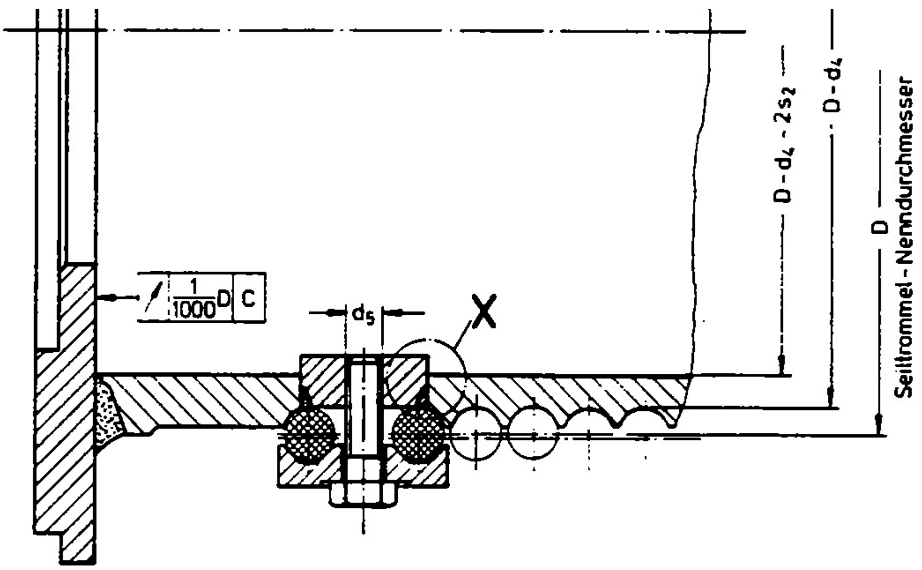
2.4.2.5 Cable clamps (Ausschuß für Anlagentechnik, 1992)

According to the standard DIN 15020 – 1, the cable clamps on hoisting drums have to hold at least 2,5 times the cable force, considering that the friction on the drum is calculated with μ = 0,1 and there are a minimum of two reserve windings.

$$\boldsymbol{S_2} = \frac{2{,}5 \times S}{e^{\mu \widehat{\alpha_1}}} \qquad \text{Eq: 2-13}$$

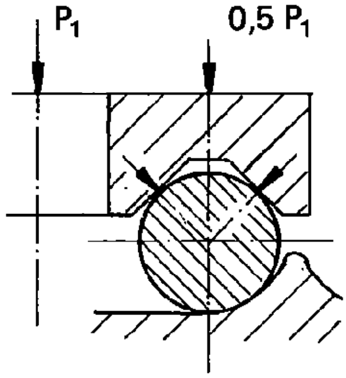
S	Actual cable force $[N]$
S_2	Calculated cable force (DIN 15020) $[N]$
μ	Friction between cable and drum (μ = 0,1) $[-]$
$\widehat{\alpha_1}$	Radian measure ($\widehat{\alpha_1} = 2 \times \pi \times$ reserve windings $\geq 4 \times \pi$) $[-]$

2.4.2.5.1 Clamping on the drum (double clamps)



Picture 2-16: Mounting of the cable clamps

The picture above shows how the cable clamps are mounted on the drum. As obvious, the screw force is devided by the amount of cables which are beneath the clamp. Furthermore the force is then split into two forces that are applied on the cable under an angle of 45° (See next picture).



Picture 2-17: Forces at a double clamp

In the first groove beneath the double clamp the cable force is decreased by the amount of the resulting friction force R_1, due to the preloaded screw force P_{Vorsp}. (Ausschuß für Anlagentechnik, 1992)

$$\boldsymbol{R_1 = (0,5 \times P_1 \times 0,707 \times \mu \times 2 + 0,5 \times P_1 \times \mu) \times 2 = 0,2414 \times P_1} \qquad \text{Eq: 2-14}$$

$$\boldsymbol{P_1 = \frac{P_{Vorsp}}{\nu}} \qquad \text{Eq: 2-15}$$

P_{Vorsp} Preloaded screw force out of the starting torque for screws with a strength of 8.8 (Picture 8-8 on page 144) $[N]$

R_1 Friction force for which the cable force is lowered $[N]$

$$\boldsymbol{\nu = \frac{1,8}{0,7} = 2,57} \qquad \text{Eq: 2-16}$$

0,7 This factor is concerned with the inaccuracy of 30% when applying the starting torque. $[-]$

1,8 This factor is concerned with the shrinkage behavior of screwed connections and cables with steel core or fiber core (Details in chapter 8.1.5 Cable clamps on page 144). $[-]$

$$\boldsymbol{S_3 = S_2 - R_1} \qquad \text{Eq: 2-17}$$

S_3 Is the cable force after the first clamp $[N]$

$$\boldsymbol{S_4 = \frac{S_3}{e^{\mu \widehat{\alpha_2}}}} \qquad \text{Eq: 2-18}$$

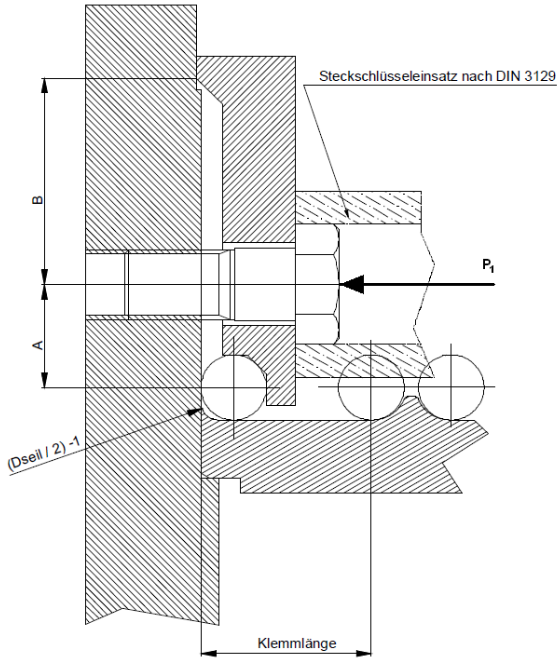
S4 Is the cable force directly before the next cable clamp $[N]$

$\widehat{\alpha_2}$ Radian measure; the cable clamps are shifted 120° ($\widehat{\alpha_2} = \frac{2}{3} \times \pi$) $[-]$

The last two equations are repeated continuously till the calculated cable force is negative (This should always happen before the last clamp).

2.4.2.5.2 Clamping on the flanged wheel (single clamps)

The calculation for the clamps on the flanged wheel is similar to the one on the drum. The difference is that the clamps are not double but single and thereby the "clamping ratio" (Picture 2-18; ratio $\frac{A}{B}$), which can be selected, plays a major role in this calculation. The higher the ratio, the higher is the force from the screw that is applied on the cable.



Picture 2-18: Forces at a flanged wheel clamp

$$\boldsymbol{S_2} = \frac{\boldsymbol{2{,}5 \times S}}{\boldsymbol{e^{\mu \widehat{\alpha_1}}}} \qquad \text{Eq: 2-19}$$

S_2 calculated cable force (DIN 15020) $[N]$

$\widehat{\alpha_1}$ Radian measure, $(\widehat{\alpha_1} = 2 \times \pi \times (\text{reserve windings} + 1) \geq 6 \times \pi)$ the value +1 is because the cable wraps around the drum one more time due to the type of clamping $[-]$

$$\boldsymbol{R_1} = \left(\frac{\boldsymbol{A}}{\boldsymbol{B}} \times \boldsymbol{P_1} \times \boldsymbol{\mu} \times \mathbf{2}\right) \times \mathbf{2} = \mathbf{0{,}4} \times \frac{\boldsymbol{A}}{\boldsymbol{B}} \times \boldsymbol{P_1} \qquad \text{Eq: 2-20}$$

The parameters in the equation above are already described in the chapter before.

$$\boldsymbol{S_3} = \boldsymbol{S_2} - \boldsymbol{x} \times \boldsymbol{R_1} \qquad \text{Eq: 2-21}$$

x Is the amount of cable clamps that are chosen (At least so many so that the calculated cable force is negative) $[-]$

2.4.2.6 Calculations according to Ernst

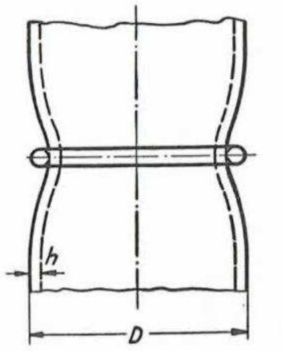
The calculation according to Ernst is one of the oldest and best known. In this case his approach was used to find the thickness of the mantle, the flanged wheel and the deflecting angle.

2.4.2.6.1 Thickness of the drum

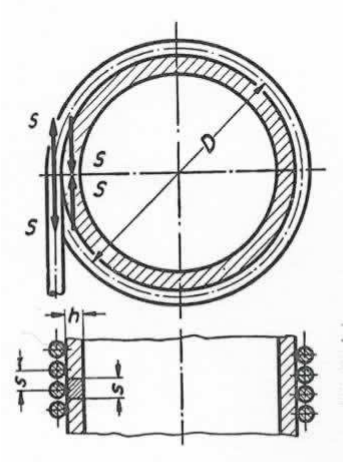
According to Ernst there are three factors that influence the thickness:

1. The turning load due to the torque.
2. The bending load due to the strain of the cable.
3. Lacing of the drum due to the cable windings.

The only load that is of real importance is the one due to the lacing of the drum. The turning of the drum is so small that it can be neglected as well as the bending of the drum, which only have an influence on really long drums.



Picture 2-19: Deformation of the mantle due to one winding



Picture 2-20: Pressure load of the drum while fully wrapped

The load because of the lacing is caused by pressure and bending. If the load is as depicted as in Picture 2-19 the calculated pressure would be:

$$\sigma_a = \frac{S}{h \times s} \qquad \text{Eq: 2-22}$$

S Cable load $[N]$

h Mantle thickness $[mm]$

s Cable groove gradient $[mm]$

σ_a Pressure at the point where the cable runs onto the drum $[\frac{N}{mm^2}]$

But in reality this pressure can be reduced by a factor of 0,5, because at the point where the cable runs onto the drum on the side where the cable is already wrapped around the drum, the pressure decreases as the cable force decreases due to friction. The second factor is that the other side of the drum is still unloaded.

$$\boldsymbol{\sigma_a = 0,5 \times \frac{S}{h \times s}} \qquad \text{Eq: 2-23}$$

Due to the fact that at this point of the drum the bending stress hasn't been able to even out like at the already wrapped part of the drum, the bending strain is presumed as:

$$\boldsymbol{\sigma_{ba} = 0,96 \times S \times \sqrt{\frac{1}{D \times h^3}}} \qquad \text{Eq: 2-24}$$

D Drum diameter related to the middle of the cable $[mm]$

σ_{ba} Bending load at the point where the cable runs onto the drum $[\frac{N}{mm^2}]$

Because these two loads are simultaneously but 90° offset, the effective load is calculated by:

$$\boldsymbol{\sigma_{max} = \sqrt{\sigma_a^2 + \sigma_{ba}^2 - \sigma_a \times \sigma_{ba}}} \qquad \text{Eq: 2-25}$$

σ_{max} Equivalent stress $[\frac{N}{mm^2}]$

The valid maximum tension is found in ÖNORM B4604-Tab.2. Concerning this project the material of the drum is made out of S355/St510 and the mantle can be a tube (notch – type A_0), a welded metal plate without subsequent machining (notch – type C) or welded with subsequent machining (notch – type B). Also the tension is multiplied by a factor of $^5/_3$ because of swelling load, but limited to 215N/mm² if necessary.

2.4.2.6.2 Thickness of the flanged wheel

The flanged wheel is also made out of a sheet metal which is stressed by bending by the diagonal pull of the cable. The minimum thickness is calculated by:

$$\boldsymbol{W = \sqrt{1,44 \times (1 - \frac{2}{3} \times \frac{D_N}{D}) \times \frac{H}{\sigma_b}}} \qquad \text{Eq: 2-26}$$

W Minimum thickness of the flanged wheel $[mm]$

D Drum diameter $[mm]$

H Axial component of the cable force $[N]$

D_N Hub diameter $[mm]$

σ_b Valid tension $[\frac{N}{mm^2}]$

A reinforcement of the flanged wheel by ribs is only necessary if the hub is strongly eccentric related to the flanged wheel. The mantle of the drum should thereby not be connected with these ribs because this is not necessary and can also be harmful. This kind of reinforcement would restrain free displacements and thereby cause tension build up at the reinforced locations. The danger of cracks emerging at these locations is great.

2.4.2.6.3 Calculating the deflecting angle

In order to prevent the cable from slipping out of the cable grooves of drums, deflection or compensation sheaves it is necessary to design the rope guiding in such a way that the cable and the grooves are always in the same surface. Due to the different designs this is not always possible and therefore a certain limit of the deflecting angle has to be specified.

The deflecting angle of the cable grooves at hoisting drums is calculated by:

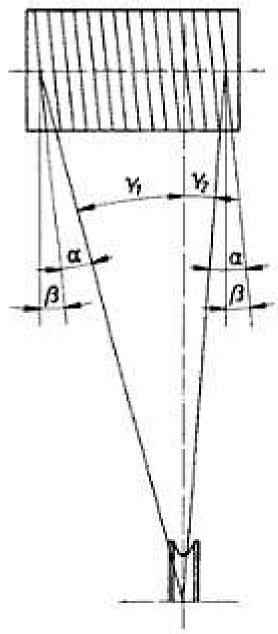
$$\tan \boldsymbol{\beta} = \frac{s}{D \times \pi} \qquad \text{Eq: 2-27}$$

s Cable groove gradient $[mm]$

D Drum diameter $[mm]$

β Angle of the cable grooves $[°]$

Concerning the maximum valid deflecting angle γ_1 when looking in the direction of the empty drum, the cable is not allowed to run onto the sides of the cable grooves. The maximum valid deflecting angle γ_2 in the other direction is limited to that point where the cable is scuffing the already wrapped cable (See following picture). A general rough estimation of these parameters is standardized in the standard DIN 15020 with 4°.



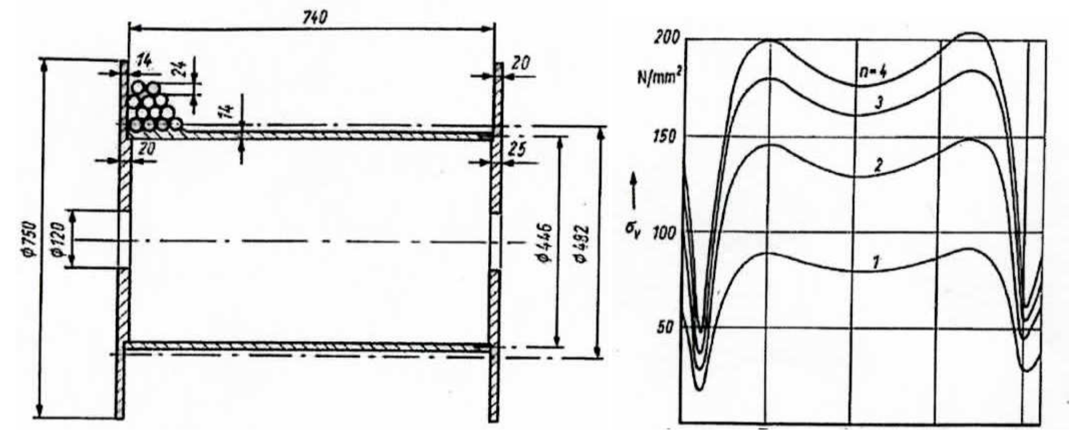
Picture 2-21: Deflecting angle of the cable on the drum

2.4.2.7 Calculation according to Scheffler

Another way to calculate the thickness of the mantle of the drum is according to Scheffler. Reasons for using this caclculation are because of some shortcomings in the calculation of Ernst. These are:

1. The material is not using its full load carrying capacity.
2. Some material, cable and drum parameters are preset and cannot be changed.
3. Multilayer drums cannot be calculated (not relevant in this case).

Also this calculation considers the increase of the load carrying capacity due to the influence of the grooves on the drum and the backlash of the flanged wheels.



Picture 2-22: Compared tension in the mantle of the drum of a multilayer fully wrapped drum, average cable force 35kN

As shown in Picture 2-22 the position of the maxima of the compared tensions, at the sides of the drum, is the result of the flanged wheels.

$$h \geq \frac{F_{Smax}}{\sigma_{zul} \times d_S} \times \varphi_d \times \varphi_R \times \varphi_E \times \varphi_\kappa \times \varphi_s \times \varphi_\delta$$ Eq: 2-28

h	Minimum mantle thickness $[mm]$
F_{Smax}	Maximum cable force $[N]$
σ_{zul}	Valid tension $[\frac{N}{mm^2}]$
d_S	Cable diameter $[mm]$
φ_d	Considers the ratio d_T / d_S (Drum diameter / cable diameter) $[-]$
φ_R	Considers the height of the grooves $[-]$
φ_E	Considers the Young's module E_S of the cable $[-]$
φ_κ	Considers the filling factor of the cable $[-]$
φ_S	Considers the cable groove gradient $[-]$
φ_δ	Considers the support angle δ of the groove (only used at multilayer drums) $[-]$

The values for the φ – factors are found in Picture 8-10 on page 146

2.4.2.8 CEN/TS 13001 – 3

On all cranes the cable is always stressed through the load and the amount of bends of the cable. Both determine the load cycle, which is classified in s_R groups (See Picture 8-11 on page 147). These classifications are used to select the cable and the diameter of the drum and/or the turning sheave. They are time independent. The static stability and durability have to be fulfilled in order to select the right components.

This standard is another way to calculate the minimum cable diameter. When compared to DIN 15020 it takes different factors into account. For example the mode of how the weight is lifted, eventual horizontal forces or the course of the deflecting angle.

2.4.2.8.1 Static stability

In order to prove the static stability the following equation has to be fulfilled:

$$F_{Sd,s} \geq F_{Rd,s}$$ Eq: 2-29

$F_{Sd,s}$	Cable force $[N]$
$F_{Rd,s}$	Boundary cable force $[N]$

Cable force for vertical lifting

$$F_{Sd,s} = \frac{m_{Hr} \times g}{n_f} \times \phi \times f_{S1} \times f_{S2} \times f_{S3} \times \gamma_P \times \gamma_n$$ Eq: 2-30

m_{Hr}	That part of the load that is dedicated to the according cable strands. The load contains the lifting weight, the weight of the lifting beam and part of the cables. $[kg]$
g	Gravitational constant $[\frac{m}{s^2}]$
n_f	Amount of cable strands that hold the weight m_{Hr} $[-]$
γ_P	Part safety factor (See standard CEN/TS 13001 – 2) $[-]$
γ_n	Risk factor (See CEN/TS 13001 – 2) $[-]$
ϕ	Dynamic factor due to inertial and gravitational effects (See CEN/TS 13001 – 2) $[-]$
$f_{S1} - f_{S3}$	Factors that increase the cable force $[-]$

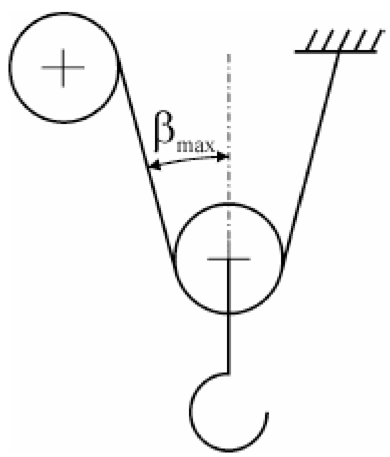
Factor that increases the cable force due to the efficiency factor of the rope drive:

$$\boldsymbol{f_{S1}} = \frac{\mathbf{1}}{\boldsymbol{\eta_{tot}}} \qquad \text{Eq: 2-31}$$

η_{tot}	Overall efficiency factor of the rope drive, calculated the same way like DIN 15020 $[-]$

Factor concerning the nonparallel cable strands:

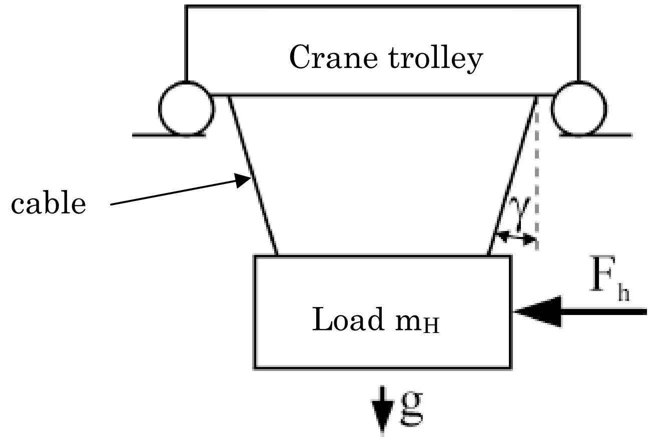
$$\boldsymbol{f_{S2}} = \frac{\mathbf{1}}{\mathbf{cos}\,\boldsymbol{\beta_{max}}} \qquad \text{Eq: 2-32}$$



Picture 2-23: Factor concerning the nonparallel cable strands, static stability

Factor concerning the horizontal forces on the load:

$$\boldsymbol{f_{S3}} = \mathbf{1} + \frac{\boldsymbol{F_h}}{\boldsymbol{m_H} \times \boldsymbol{g} \times \mathbf{tan}\,\boldsymbol{\gamma}} \leq \mathbf{2} \qquad \text{Eq: 2-33}$$



Picture 2-24: Horizontal force on the load

Boundary cable force

$$\boldsymbol{F_{Rd,s}} = \frac{\boldsymbol{F_u}}{\boldsymbol{\gamma_{rb}}}$$ Eq: 2-34

F_u	Minimum cable breaking force according to the manufacturer $[N]$
γ_{rb}	Minimum cable resistance factor $[-]$

The minimum resistance factor is depending on the geometry of the rope drive and is calculated by:

$$\boldsymbol{\gamma_{rb}} = \mathbf{1,34} + \frac{\mathbf{5}}{\left(\frac{\boldsymbol{D}}{\boldsymbol{d}}\right)^{\mathbf{0,8}} - \mathbf{4}}$$ Eq: 2-35

D	Smallest relevant diameter $D = Min(D_{sheave}; 1{,}125 \times D_{Drum}; 1{,}125 \times D_{comp})[mm]$
d	Cable diameter $[mm]$

2.4.2.8.2 Operational stability

In order to prove the operational stability the following equation has to be fulfilled:

$$\boldsymbol{F_{Sd,f}} \geq \boldsymbol{F_{Rd,f}}$$ Eq: 2-36

$F_{Sd,f}$	Cable force (For the operational stability) $[N]$
$F_{Rd,f}$	Boundary cable force (For the operational stability) $[N]$

Cable force

$$F_{Sd,f} = \frac{m_{Hr} \times g}{n_f} \times \phi^* \times f_{S2}{}^* \times f_{S3}{}^* \quad \text{Eq: 2-37}$$

ϕ^*	Dynamic factor due to inertial and gravitational effects $[-]$
$f_{S2}{}^*$, $f_{S3}{}^*$	Factors that increase the cable force $[-]$

In this case the cable force just has to be calculated for a constant load, thereby the values for the part safety factor γ_P, the risk factor γ_n and the cable efficiency factor are set to 1.

Due to the fact that inertial effects just last for a very short time, it is allowed to calculate the dynamic factor according to:

$$\phi^* = \phi \qquad \text{if w = 1 otherwise} \qquad \text{Eq: 2-38}$$

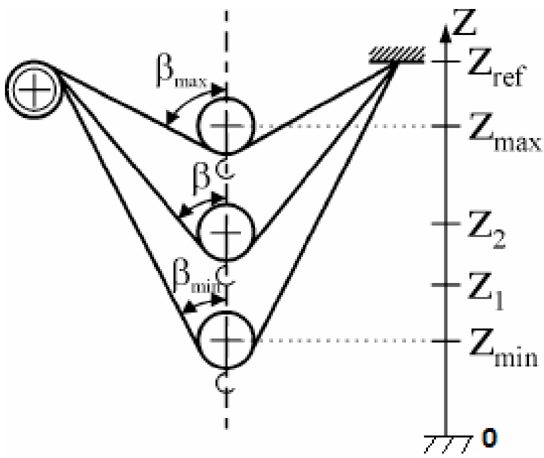
$$\phi^* = \sqrt[3]{\frac{(w-1)+\phi^3}{w}} \qquad \text{if } w \geq 2 \qquad \text{Eq: 2-39}$$

w	The relevant amount of bends of the cable per lift (Same as DIN 15020) $[-]$

Factor concerning the nonparallel cable strands:

$$f_{S2}{}^* = 1 + \left[\frac{1}{\cos\beta_{(Z_2)}} - 1\right] \times \left(\frac{Z_{ref}-Z_2}{Z_{ref}-Z_1}\right)^{0,9} \qquad \text{Eq: 2-40}$$

Z_{ref}	Referential height $[m]$
$Z_{min} - Z_{max}$	Lifting height $[m]$
$Z_1 - Z_2$	Main working area $[m]$



Picture 2-25: Factor concerning the nonparallel cable strands, operational stability

If horizontal acceleration and lifting acceleration might appear simultaneously, f_{S3} is stated by:

$$\boldsymbol{f_{S3}}^* = \boldsymbol{f_{S3}} \qquad \text{Eq: 2-41}$$

Otherwise f_{S3}* can be set to 1.

Boundary cable force

$$\boldsymbol{F_{Rd,f}} = \frac{\boldsymbol{F_u}}{\sqrt[3]{s_r} \times \gamma_{rf}} \times \boldsymbol{f_f} \qquad \text{Eq: 2-42}$$

s_r Factor that determines the course of the cable force to the time. It can be calculated according to CEN/TS 13001 – 3 or selected out of the s_r groups (See Picture 8-11 on page 147). [–]

γ_{rf} Minimum cable resistance factor $\gamma_{rf} = 7$ [–]

f_f Factor concerning other influences [–]

$$\boldsymbol{f_f} = \boldsymbol{f_{f1}} \times \boldsymbol{f_{f2}} \times \boldsymbol{f_{f3}} \times \boldsymbol{f_{f4}} \times \boldsymbol{f_{f5}} \times \boldsymbol{f_{f6}} \times \boldsymbol{f_{f7}} \qquad \text{Eq: 2-43}$$

Factor that is concerned with the diameters of the rope drive:

$$\boldsymbol{f_{f1}} = \frac{\frac{\boldsymbol{D}}{\boldsymbol{d}}}{\boldsymbol{R_{Dd}}} \qquad \text{Eq: 2-44}$$

The chosen ratio of $\frac{D}{d}$ is not allowed to be smaller than 11,2 and has to be chosen in that way, so that f_{f1} is higher than 0,75.

$$\boldsymbol{R_{Dd}} = \boldsymbol{10} \times \boldsymbol{1,125}^{\log_2\left(\frac{s_r}{0,004}\right)} \qquad \text{Eq: 2-45}$$

Factor that is concerned with the strength of a single wire:

$$\boldsymbol{f_{f2}} = \left(\frac{\boldsymbol{1770}[\frac{N}{mm^2}]}{\boldsymbol{R_r}}\right)^{\boldsymbol{0,4}} \quad \text{if } R_r > 1770[\frac{N}{mm^2}] \text{ otherwise} \qquad \text{Eq: 2-46}$$

$$\boldsymbol{f_{f2}} = \boldsymbol{1}$$

R_r Tensile strength of the wire the cable is made out of $[\frac{N}{mm^2}]$

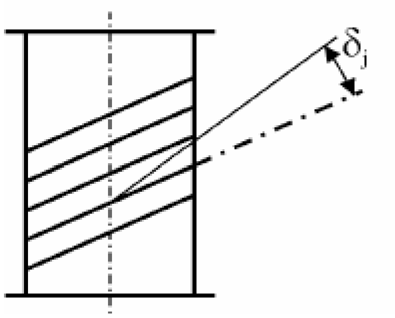
Factor that is concerned with the deflecting angle:

The factor f_{f3} is selected out of the table shown in Picture 8-12 on page 147. For this the average deflecting angle has to be calculated.

$$\boldsymbol{\delta} = \sqrt[3]{\frac{\sum_{j=1}^{n} \delta_j^3}{n}} \qquad \text{Eq: 2-47}$$

δ_j Deflecting angle at the tangential point of contact at the drum (See following picture) [°]

n Amount of contact points of that part of the cable which gets bent the most. [–]



Picture 2-26: Deflecting angle

f_{f4} Factor that is concerned with the lubrication of the cable

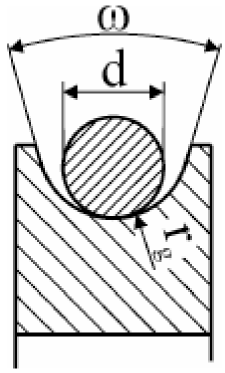
If the cable is lubricated, the factor $f_{f4} = 1$, otherwise the factor has to be chosen ≤ 0,5 (e.g. clean room environment).

f_{f5} Factor that is concerned with multilayer drums

If there is more than one layer of cable wrapped around the drum, the factor f_{f5} has to be chosen ≤ 0,8.

f_{f6} Factor that is concerned with the cable groove radius

The factor f_{f6} is selected out of the table shown in Picture 8-13 on page 147. For this the ratio radius of the cable grooves to the cable diameter has to be calculated (See following picture).



Picture 2-27: Radius of the cable grooves

Different behavior according to fatigue due to the amount of bends of different cable types is considered by the factor f_{f7}.

$$\boldsymbol{f_{f7} = \frac{1}{t}} \qquad \text{Eq: 2-48}$$

f_{f7}	Factor that is concerned with the type of the cable
t	Factor for the type of the cable $[-]$

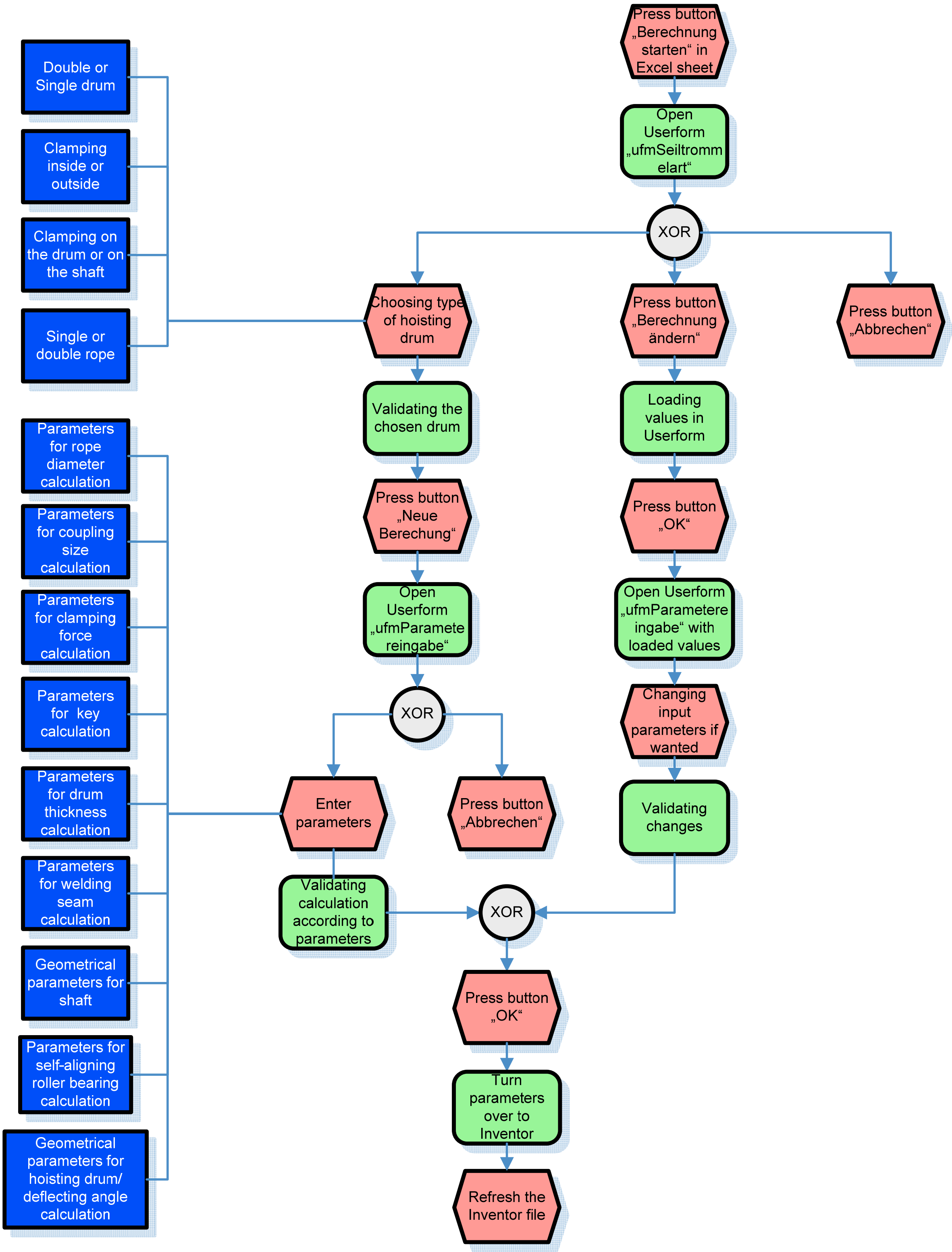
Generally speaking, a value for $t = 1$ is valid for cables that are free of turning and have between 6 and 10 outside wires. For other cables, values between 0,95 and 1,25 can be specified by the manufacturer.

3 Designing the sequence of operations

Many trials were performed in order to determine the best way to combine all the software (Excel, VBA, Inventor. iLogic) that stood to my disposal. The outcome of these trials was that the task had to be split into two parts. One was the Excel file where all the calculations are done and the other one is the Inventor assembly – file where the calculated values are loaded into, and the 3D – model is generated. The following pictures show how the VBA – code works, how the connection between these two programs are made and how the different types of drums are realized by using iLogic.

The used describing methods are eEPC (Event Process Chain) diagrams for a basic overview or basic flow chart diagrams if the level of detail had to be higher.

3.1 Rough program concept



Picture 3-1: Rough program concept

After opening the Excel file “Trommelparameter_2.xls” the button “Berechnung starten” in the sheet “Berechnung” has to be pressed. This starts the calculation and shows the first input mask. There are two options available:

1. Start a new calculation
2. Change an already existing calculation

3.1.1 Start a new calculation

If this path is chosen, the type of drum has to be entered first. After pressing the button “Neue Berechnung”, in the next few masks, values for calculation and geometrical data, have to be entered. If the input of this data is complete, the program allows you to finish the calculation. By pressing the button “OK” in the last input mask all input masks disappear (The execution of the program can be aborted at any time). Now the Excel file has to be saved in order to make the changes valid. After this the Inventor file has to be refreshed by pressing first the button “Refresh” which changes all the length values and then the button “iTrigger” to change the type of drum.

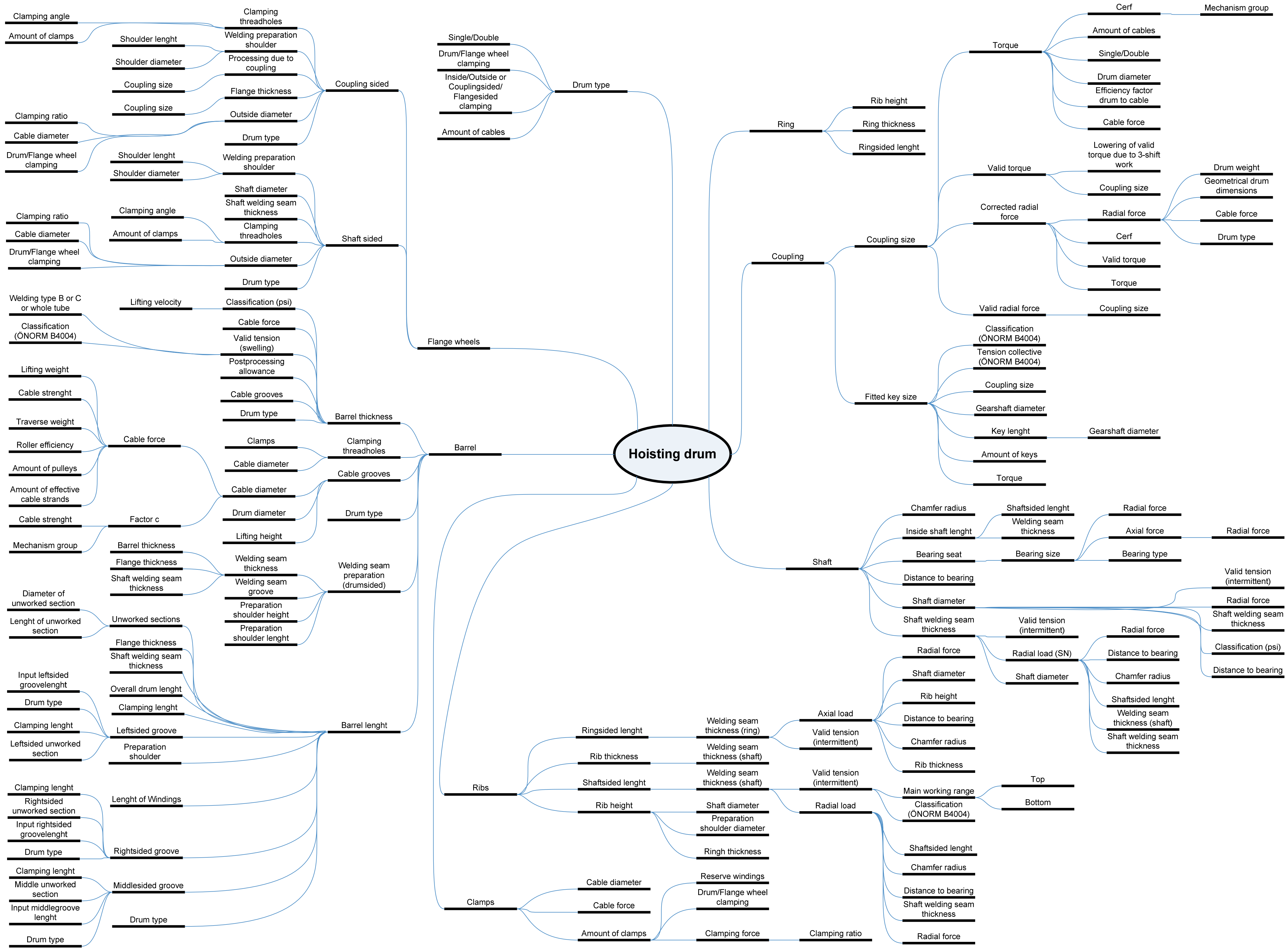
3.1.2 Change an already existing calculation

If a calculation already exists, this path allows you to change the defining values. When pressing the button “Berechnung ändern” the settings of the type of hoisting drum are loaded into the mask (These settings can’t be changed). By pressing the button a second time the whole data of the existing drum is loaded into the next masks. Now, in case these values have to be changed, it is necessary to start from the beginning and work the way trough in order to implement all the changes that are made (Some changes can affect values that are not considered!). If all the changes are done, the program can be closed by pressing the button “OK” (The execution of the program can be aborted at any time). The next steps are the same as with a new calculation.

3.2 From the input mask to the calculation

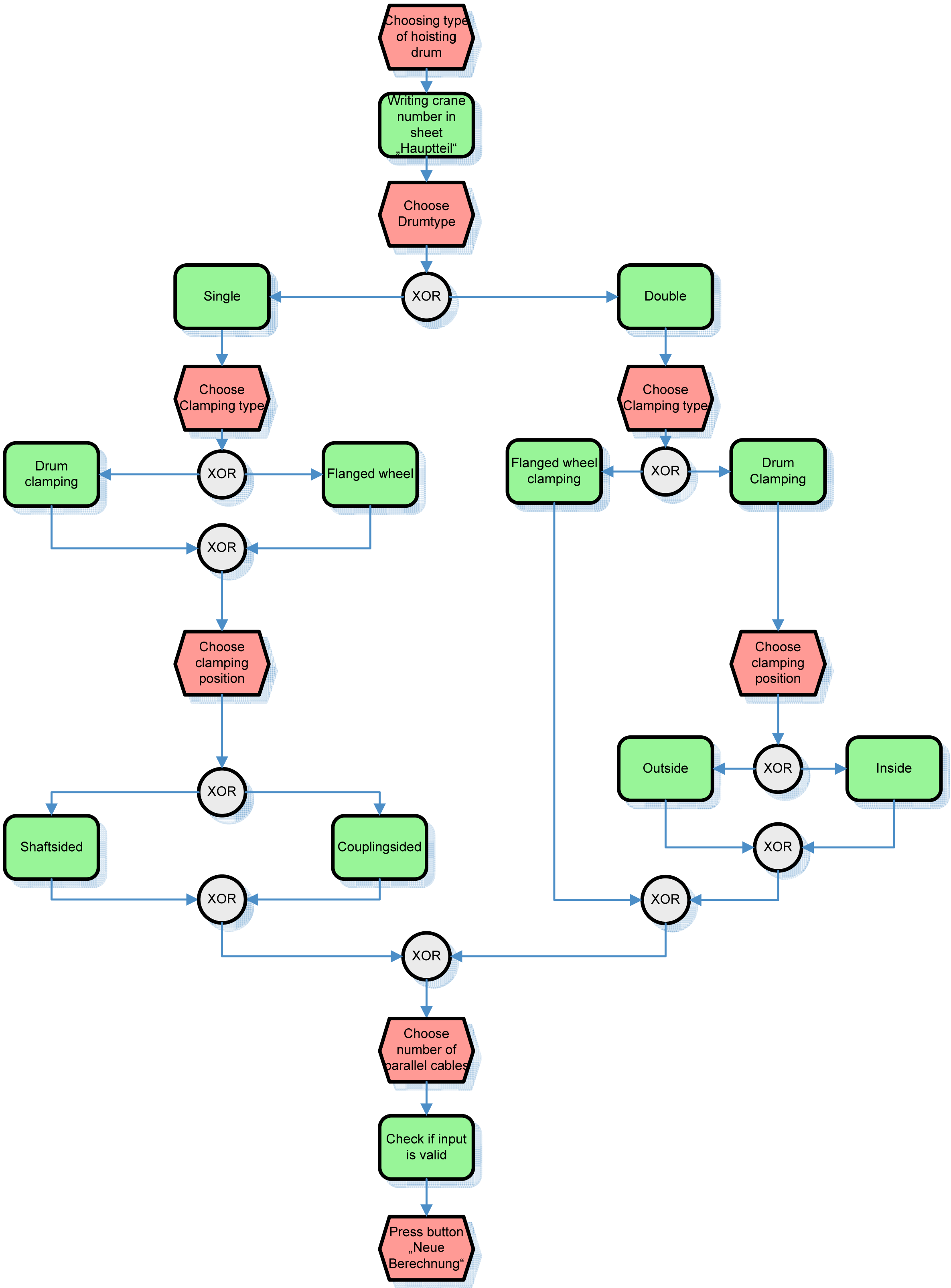
In order to make the necessary calculations in Excel, the entered values have to be copied from the input mask to the Excel – sheet (2nd column of the sheet "Berechnung"). These values are either written into Textboxes or chosen by Option buttons. If a value is necessary for a calculation but doesn't have to be entered by the user (e.g., Cable weight/meter, maximum torque of the coupling...) it is written in the 6th column of the sheet "Berechnung" by the program. Excepted are valid maximum tensions which are written into the 18th column, in order to have a better overview.

The diagram on the next page shows which input parameter effects which part of the drum. These parameters are later on described in detail in the following chapters.



Picture 3-2: Connections of input parameters and the features of the hoisting drum

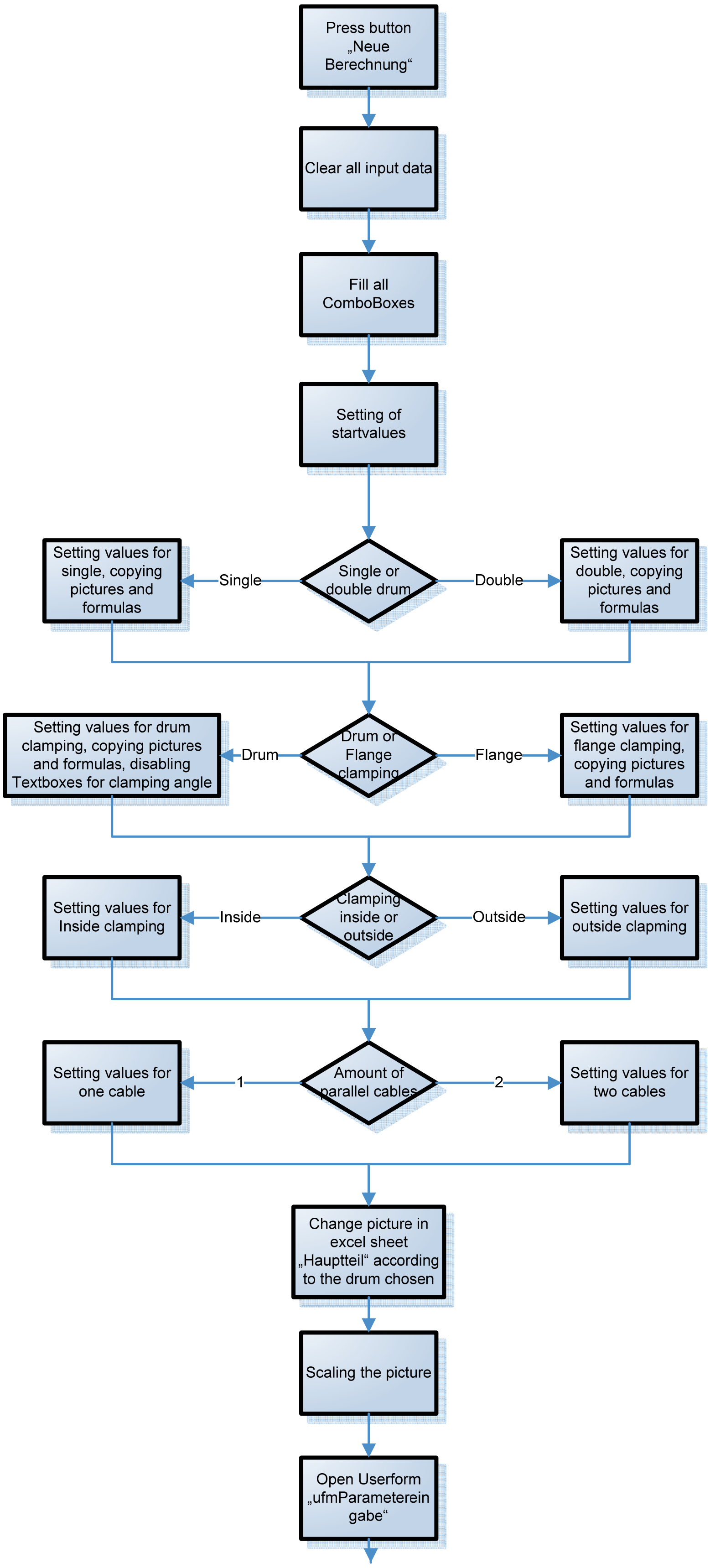
3.2.1 Choosing the type of drum



Picture 3-3: Choosing the drum type

As described in Picture 3-3 some options cancel other options or change the meaning of them. For example the position of the cable clamps at a double drum with flanged wheel clamping can just be outside, because there are no flanged wheels in the middle of the drum. Another example would be a change of the meaning of the option buttons “Outside” or “Inside” to “Shaft sided” or “Coupling sided” by changing from a double to a single drum. Picture 3-4 shows the order of events after pressing the button “Neue Berechnung”.

The whole program is described in one big flowchart which is split into chapters in the following pages. The arrow on the top of one chart indicates that it is the continuation of a previous one and in the same sence the arrow on the bottom indicates that the chart continues on the next page.

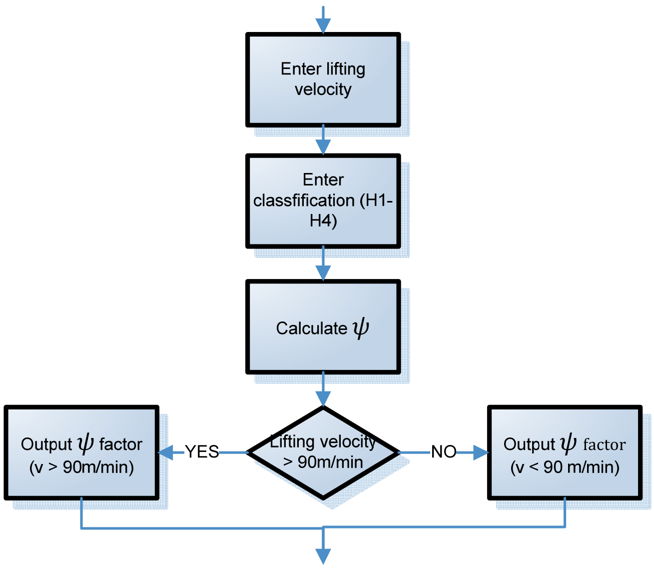


Picture 3-4: Press button "Neue Berechnung"

Step by step description of the events described in Picture 3-4:

1. To make sure that no previously input value falsifies the new calculation, all data is erased from the memory (2nd column of Excel sheet "Berechnung").
2. The next step fills all Combo boxes with the selectable values (e.g., mechanism group, cable diameters...).
3. Input of starting values into the Excel sheet, these are preset values in the input masks, due to the fact that they are changed very seldom (e.g., welding seam preparation).
4. In the next steps the values are set in the Excel sheet "Berechnung" according to the type of drum. Furthermore pictures and formulas are changed so that the formatting fits the Excel sheet "Hauptteil", which can be printed out for documentation purposes afterwards. Also some Textboxes in the next input mask are disabled if they are not needed.
5. After that the next input mask pops up and the cable calculation can start.

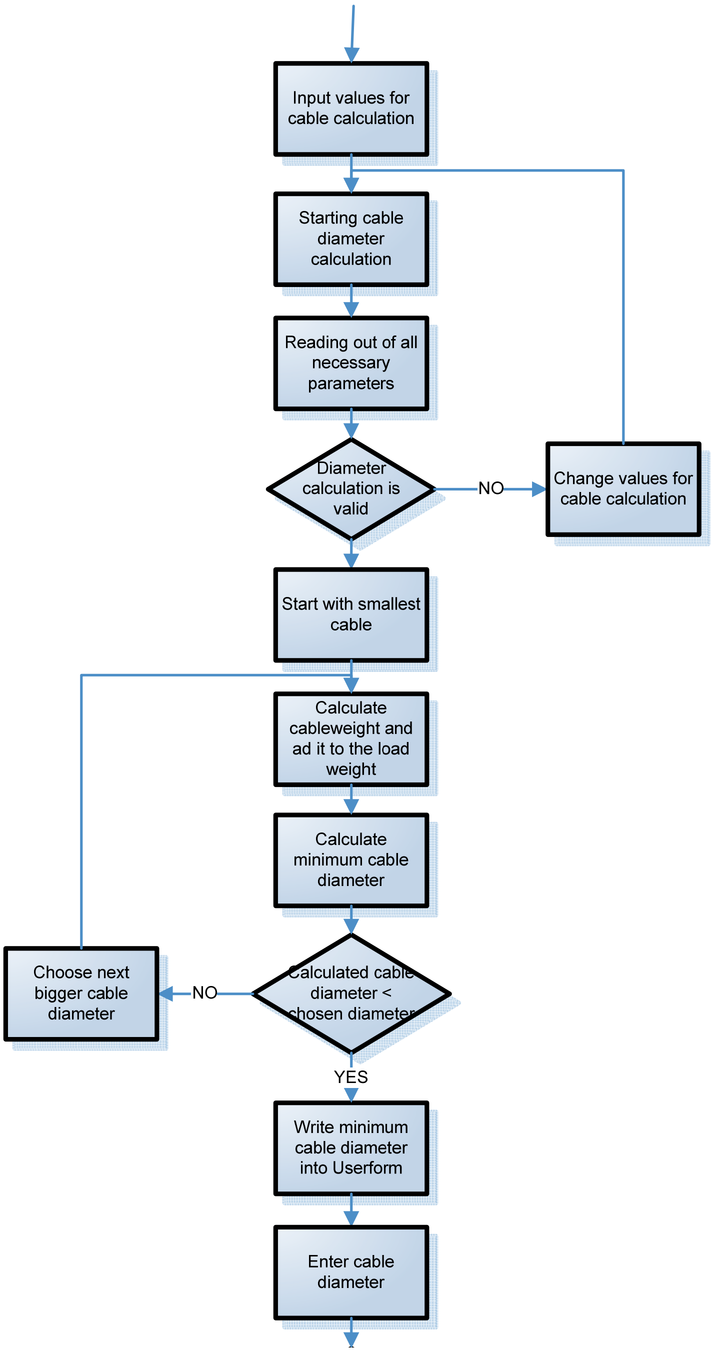
3.2.2 Calculation of the ψ factor (ÖNORM B4004-1)



Picture 3-5: Calculation of the ψ factor

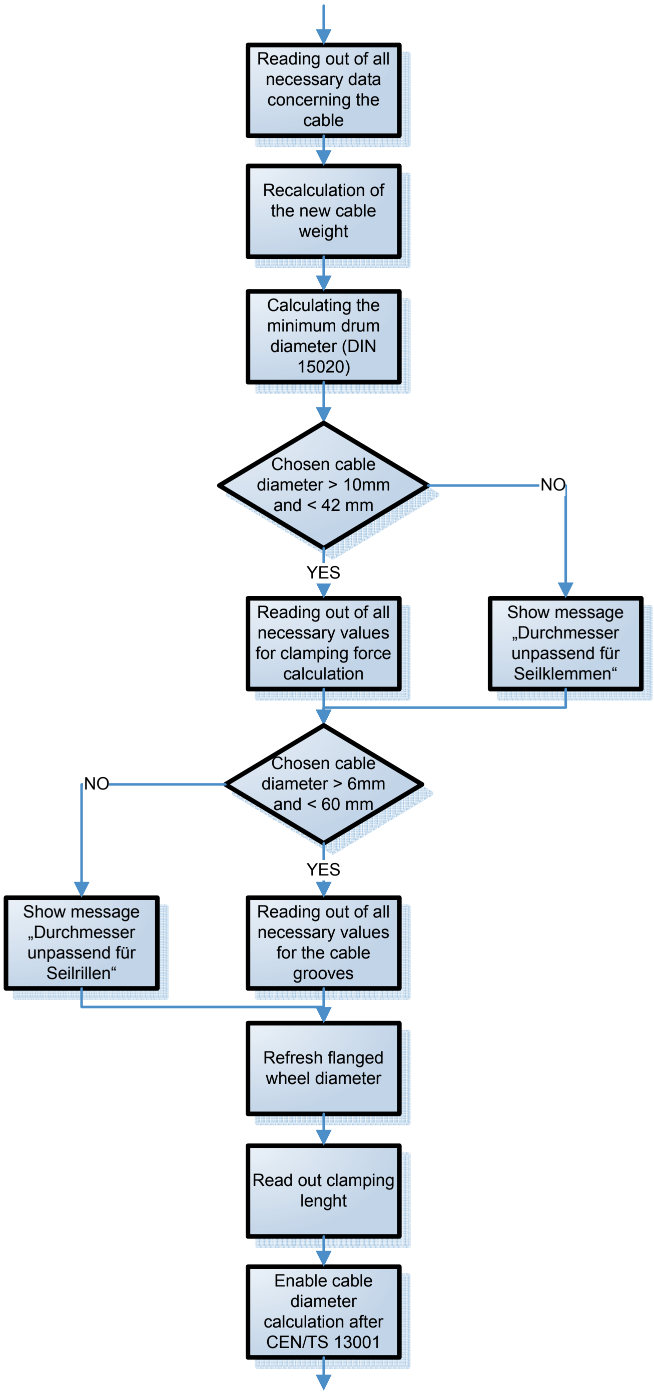
Depending on the lifting velocity the ψ factor is calculated in different ways. The factor is concerned with the course of the lifting acceleration and the stiffness of the crane and influences the thickness of the drum in the calculation according to Ernst.

3.2.3 Cable calculation



Picture 3-6: Cable calculation

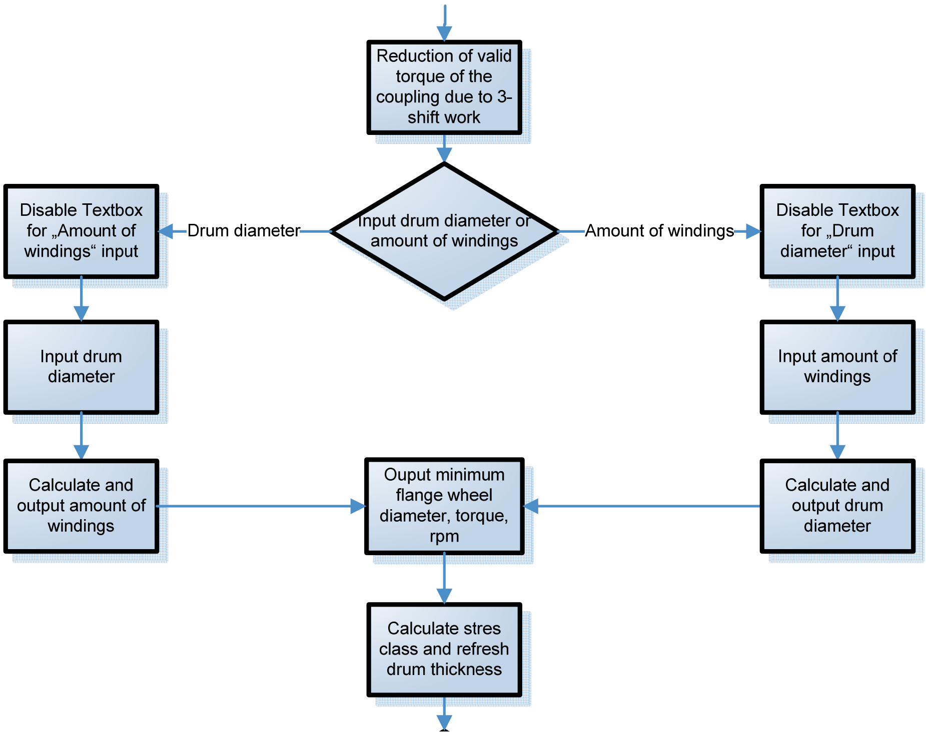
After all values, that are necessary to calculate the minimum cable diameter, are entered and validated (meaning no division through zero), the calculation process begins. This means, by starting with the smallest cable diameter, the weight of the cable is calculated and then added up to the lifting weight and the weight of the lifting beam. With this total weight the minimum cable diameter is calculated. If this diameter is then smaller than the chosen one, the calculated value is shown at the input mask. Otherwise the calculation starts again with the next bigger cable diameter.



Picture 3-7: Events when cable diameter is entered

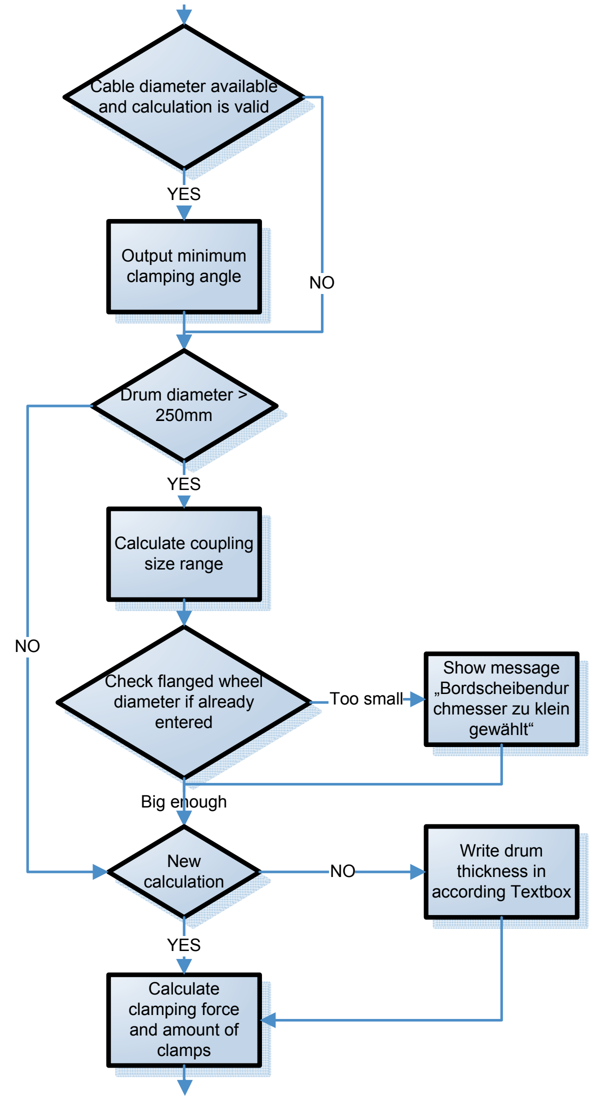
When the cable diameter is entered, all the necessary values are written into the Excel sheet "Berechnung" (e.g., specific cable weight, minimum breaking strength...) and the cable weight is recalculated. After this the minimum drum diameter is calculated (DIN 15020) and shown in the input mask. If the chosen cable diameter is then in the range of 10mm to 42mm the geometrical values for the cable clamps are written into the Excel sheet "Tabelle1". Otherwise a message will appear that says that the cable diameter is not valid for the cable clamps. The next step is similar but for the geometrical values of the cable grooves. Afterwards the minimum flanged wheel diameter is refreshed (if already available) and the clamping length is calculated. Also, now that a cable is chosen, the cable calculation according to CEN/TS 13001 – 3 is enabled.

3.2.4 Calculation of minimum coupling size, flanged wheel diameter and amount of clamps



Picture 3-8: Calculation of minimum coupling size, flanged wheel diameter and amount of cable clamps, Part1

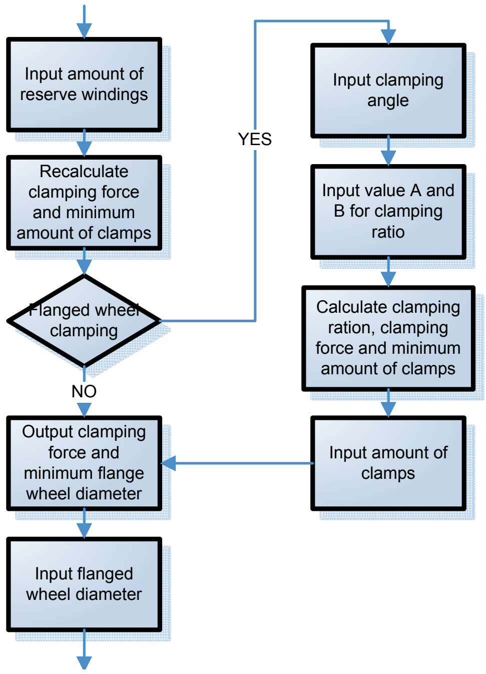
The next step is to enter the reduction of the valid torque of the coupling due to 3 – shift work. The range is from 25% to 40% and is depending on the experience of the design engineer. In some cases it is necessary to enter the drum diameter or the amount of windings. So the Option button for this desired input value has to be chosen and then the value can be entered. Instantaneously the other value is calculated and shown in the input mask. At the same time the minimum flanged wheel diameter, the torque and the revolutions per minute are calculated and shown in the input mask. Due to these changes the stress class has to be recalculated because the drum diameter influences the amount of windings in the main working area and therefore the intermittent valid tension.



Picture 3-9: Calculation of minimum coupling size, flanged wheel diameter and amount of cable clamps, Part2

The next step is to calculate the minimum clamping angle when the drum is equipped with flanged wheel clamping. This value shows the minimum distance between each clamp, which is mounted on the flanged wheel.

The minimum coupling size has an outside diameter of 240mm; therefore the entered drum diameter has to be at least 250mm in order to calculate the smallest coupling size. The next event checks the flanged wheel diameter (If it has already been entered), if it is too small. If so, a message appears which informs the user. After this, if the calculation is in the “Berechnung ändern” mode, the value for the drum thickness is written into the according Text box. Now, in case the cable is clamped on the drum, the clamping force can be calculated, otherwise the other values have to be entered beforehand.



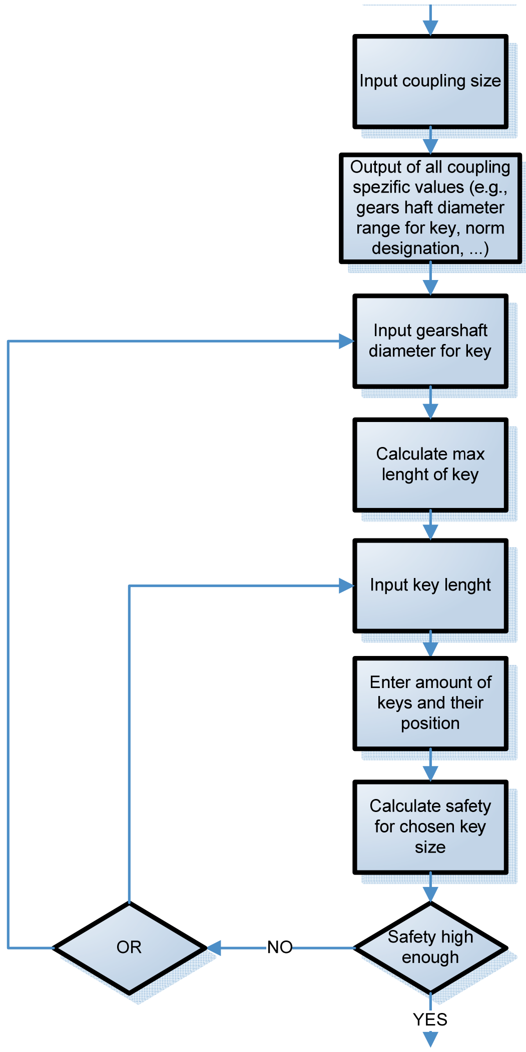
Picture 3-10: Input of clamping parameters

Usually the amount of reserve windings is changed very seldom but sometimes it is necessary (According to the standard the minimum amount of reserve windings is two and should thereby not be lowered).

The next steps describe the parameters that have to be entered in order to calculate the minimum amount of cable clamps (Just necessary with flanged wheel clamping). First the clamping angle has to be entered (Which can't be lower than the minimum clamping angle), second the clamping ratio, which describes the relative distance of the mounting screw to the cable (The higher the ratio, the higher the pressing force on the cable) and third the actual amount of cable clamps. After these values have been entered the clamping force and the minimum flanged wheel diameter can be calculated and shown on the input mask, followed by entering the actual flanged wheel diameter.

3.2.5 Selection of the coupling size and the corresponding key

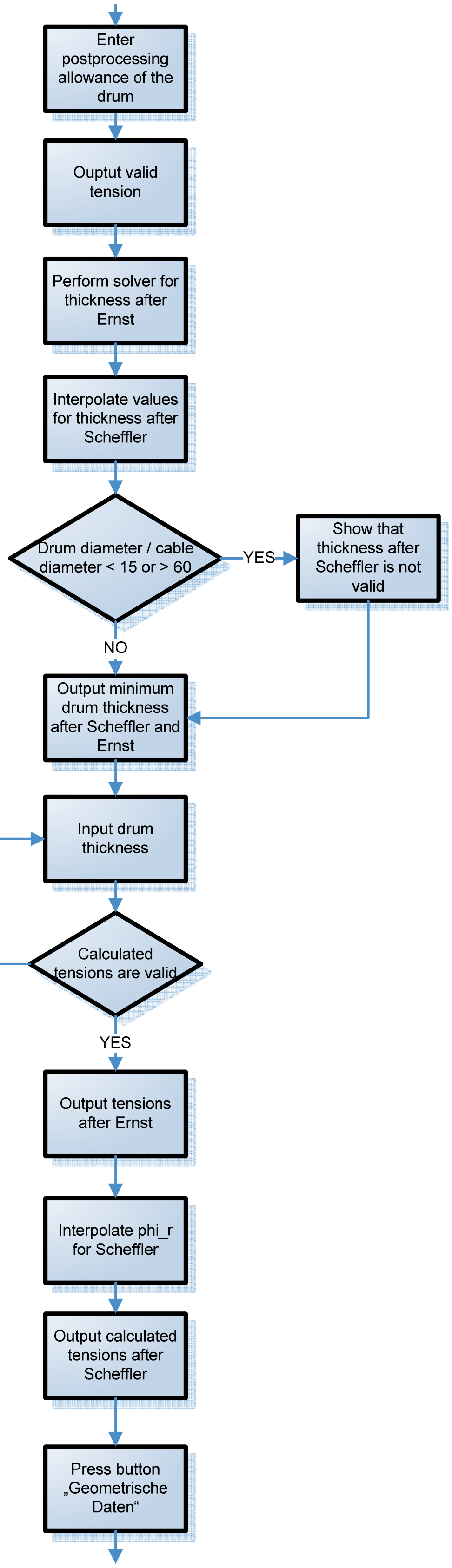
Due to the fact that the coupling size range is shown in the input mask, it can now easily be chosen from the combo box. One precondition for this was that the standard factor K_{erf} (SEB 666212) has to be shown on the input mask, so that the design engineer can cross check the value in a manufacturing catalog if either the manufacturer of these couplings has changed or the technology has evolved and smaller coupling sizes are possible. (e.g., the coupling type already changed once from TTX to TTXs which meant an increas in strength without changing the main dimensions)



Picture 3-11: Input of fitted key parameters

By choosing the coupling size all specific geometric parameters are copied to the Excel sheet "Tabelle1" and the limits of the gear shaft diameter and the corresponding length of the key are shown in the input mask. Then, when entering the gear shaft diameter, the maximum length the key can have is recalculated and shown in the input mask. By entering the length of the key the safety is calculated. Simultaneously the pictures, that show the different ways the keys can be set – up, are highlighted red if the safety is too low. If so, the diameter and the length can be reentered.

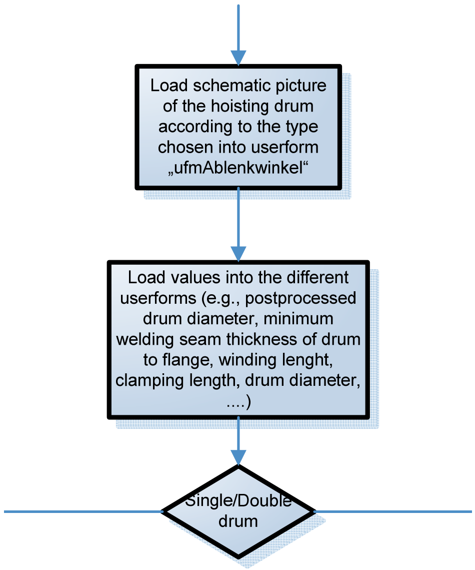
3.2.6 Calculating the minimum drum thickness



Picture 3-12: Calculating the minimum drum thickness

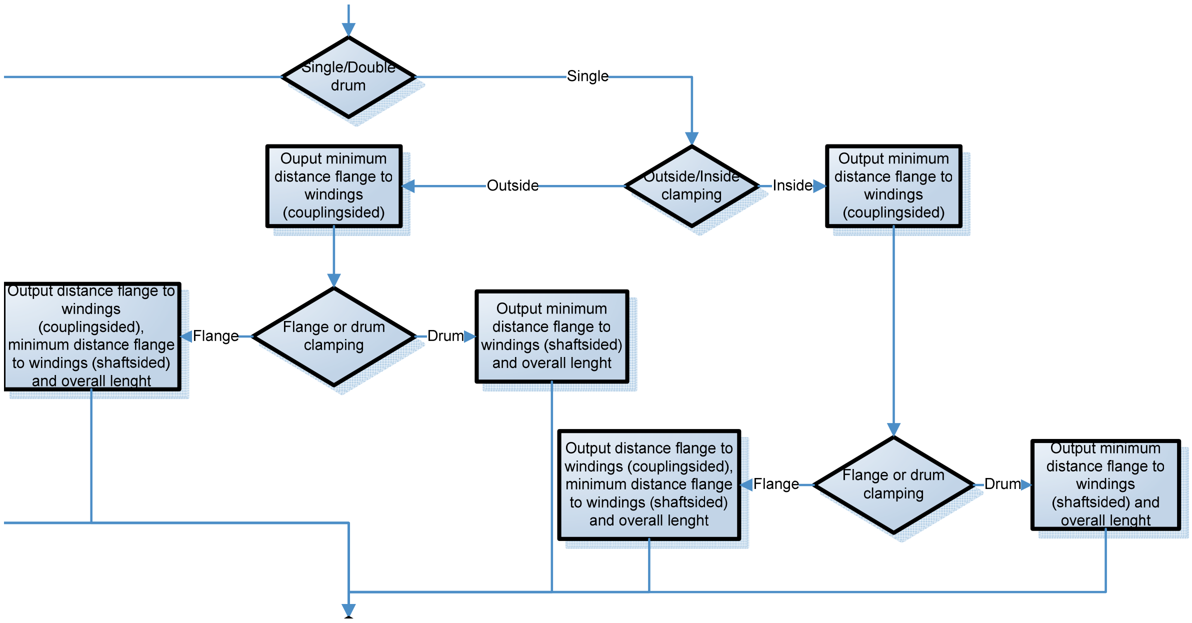
For calculating the minimum drum thickness, first the post processing allowance has to be entered. For information purposes the next step shows the valid tension which was first calculated by entering the stress class. Now the Excel internal solver calculates the minimum drum thickness according to Ernst which is used in the next step to calculate the thickness according to Scheffler (This is because Scheffler first needs an estimation of the thickness). But this value is just valid if the ratio of the drum diameter to the cable diameter is in the given range of 15 – 60 (This is because the diagrams for this calculation are just available in this range). Now the drum thickness can be entered which recalculates the thickness according to Scheffler (New estimation → new value for one of the factors according to Scheffler). The drum thickness can be reentered as many times as desired and thereby the thickness according to Scheffler is also recalculated. If then the calculated tensions, which are also shown in the input mask, are to the user's satisfaction, he / she has to press the button "Geometrische Daten" which is the last step in this input mask and opens the next input mask "ufmWellenzapfen" (ufm – shaft – extension).

3.2.7 Changing the input masks according to the drum type

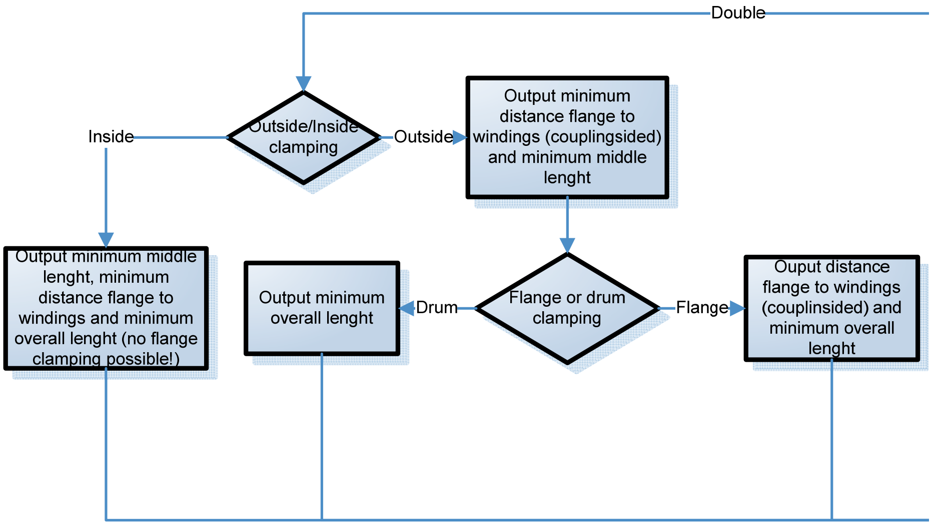


Picture 3-13: Set picture in "ufmAblenkwinkel" (ufm – deflecting angle)

Due to the different possibilities which the drum type can have, the schematic picture of it is loaded into the input mask "ufmAblenkwinel" (This is for a better understanding of the next input parameters). A few values, which are already fixed and cannot be changed anymore, are now loaded into the next input masks (e.g., minimum clamping length, length of the windings etc. in "ufmWellenzapfen", "ufmSchweißnahtvorbereitung", "ufmAblenkwinkel"). These values also depend on the chosen drum type.

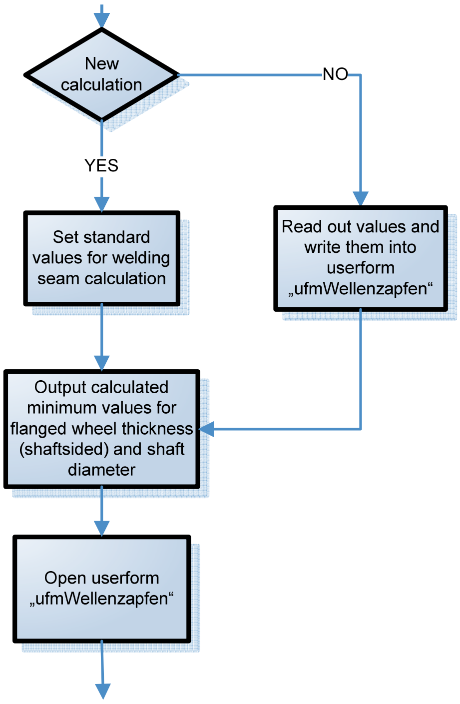


Picture 3-14: Path for drum type "Single"



Picture 3-15: Path for the drum type "Double"

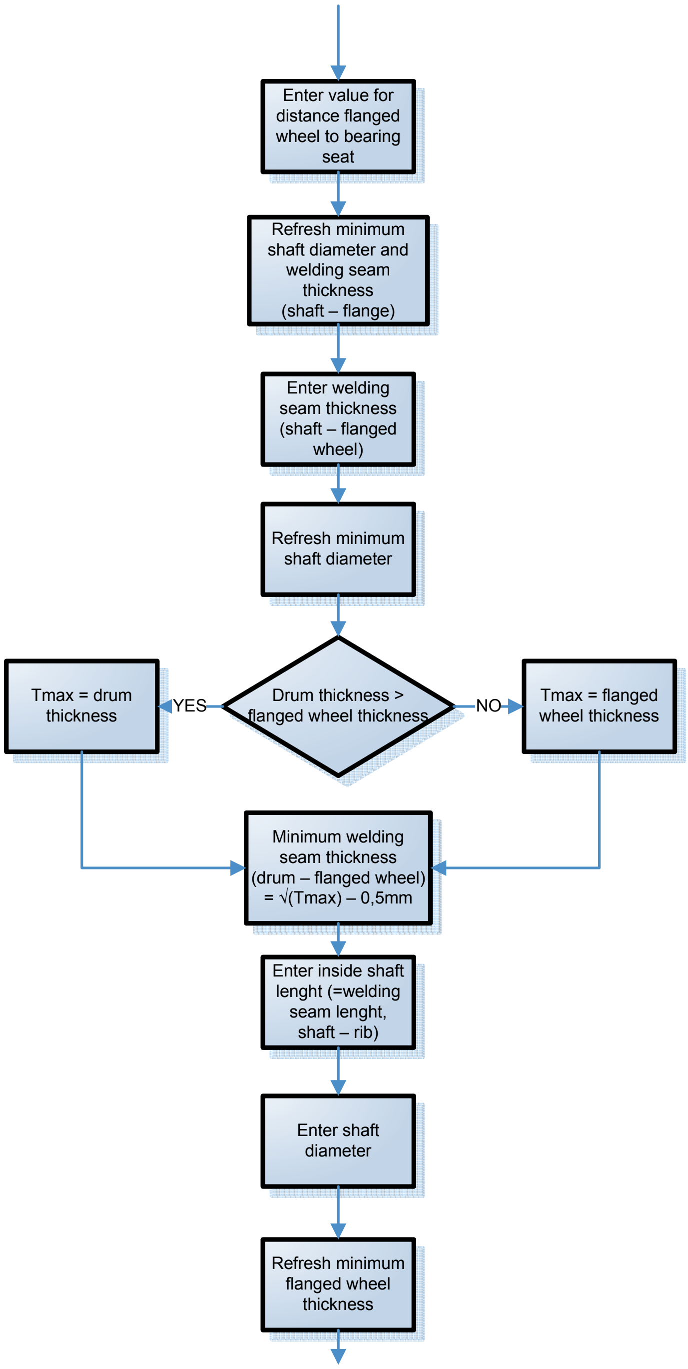
After loading theses values in the input masks, both paths now merge into one.



Picture 3-16: Set values for welding seam and flanged wheel

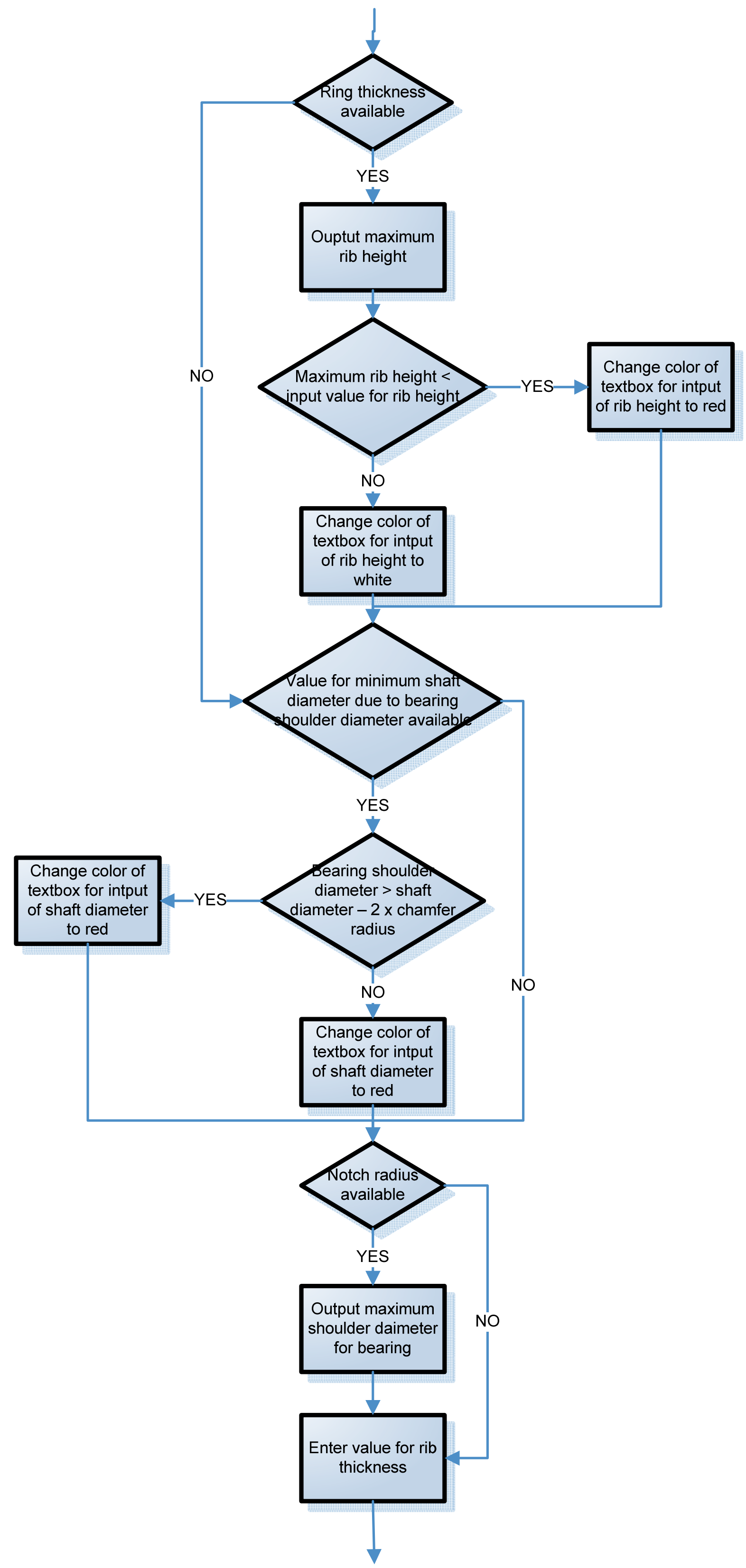
3.2.8 Entering the values of the shaft extension

The next input mask shows a schematic picture of the shaft extension including the ribs, the shaft sided flanged wheel and the ring where the ribs are welded onto. For a better understanding see Picture 4-11: "ufmWellenzapfen" empty. The next few diagrams describe the order in which the values should be entered, so that always the refreshed reference values for the next input fields are shown in the input mask. To assure the right input order, the Textbox, in which the value has to be entered next, is highlighted green.



Picture 3-17: Entering the values of the shaft extension

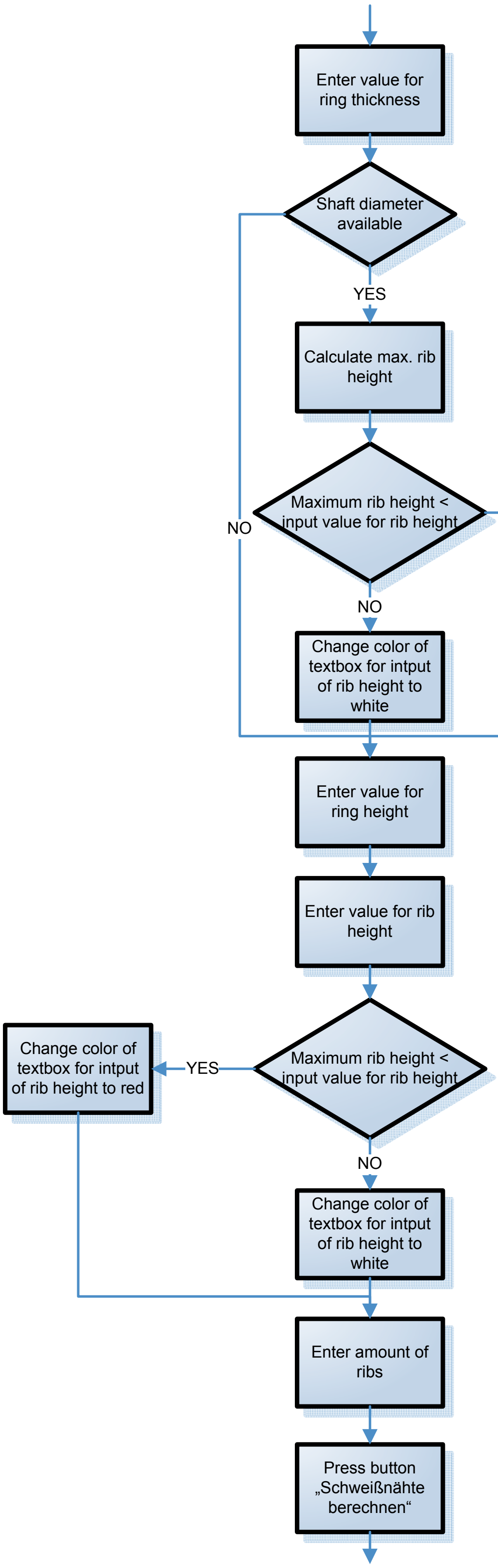
After entering the welding seam thickness of the shaft to the flanged wheel, which is the same as the flanged wheel thickness, the minimum welding seam thickness of the drum to both flanged wheels is calculated and shown in the following input mask “ufmSchweißnahtvorbereitung”.



Picture 3-18: Updating of values

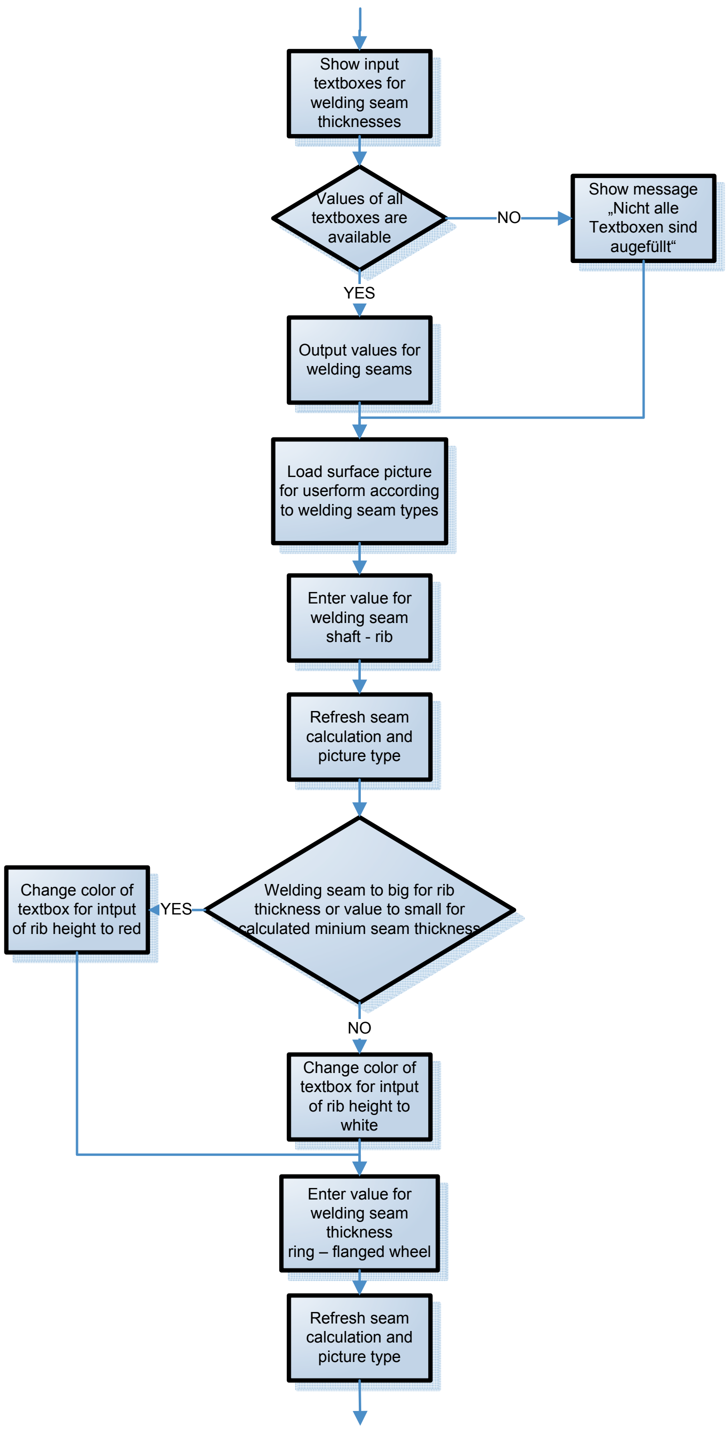
Picture 3-18 shows the events if the parameters for the ring thickness, the rib height, the bearing, or the notch radius are already available. This is usually just the case, if they have been entered before, meaning the input parameters have to be changed because they didn't fit the requirements (e.g., valid tensions, minimum welding seam thicknesses...). In a new calculation usually only the notch radius is available.

The changing of the colors of the text boxes from white to red serve the purpose of showing the user that the entered parameters have to be changed, because otherwise the 3D – model cannot be generated due to the fact that the individual parts intersect each other.



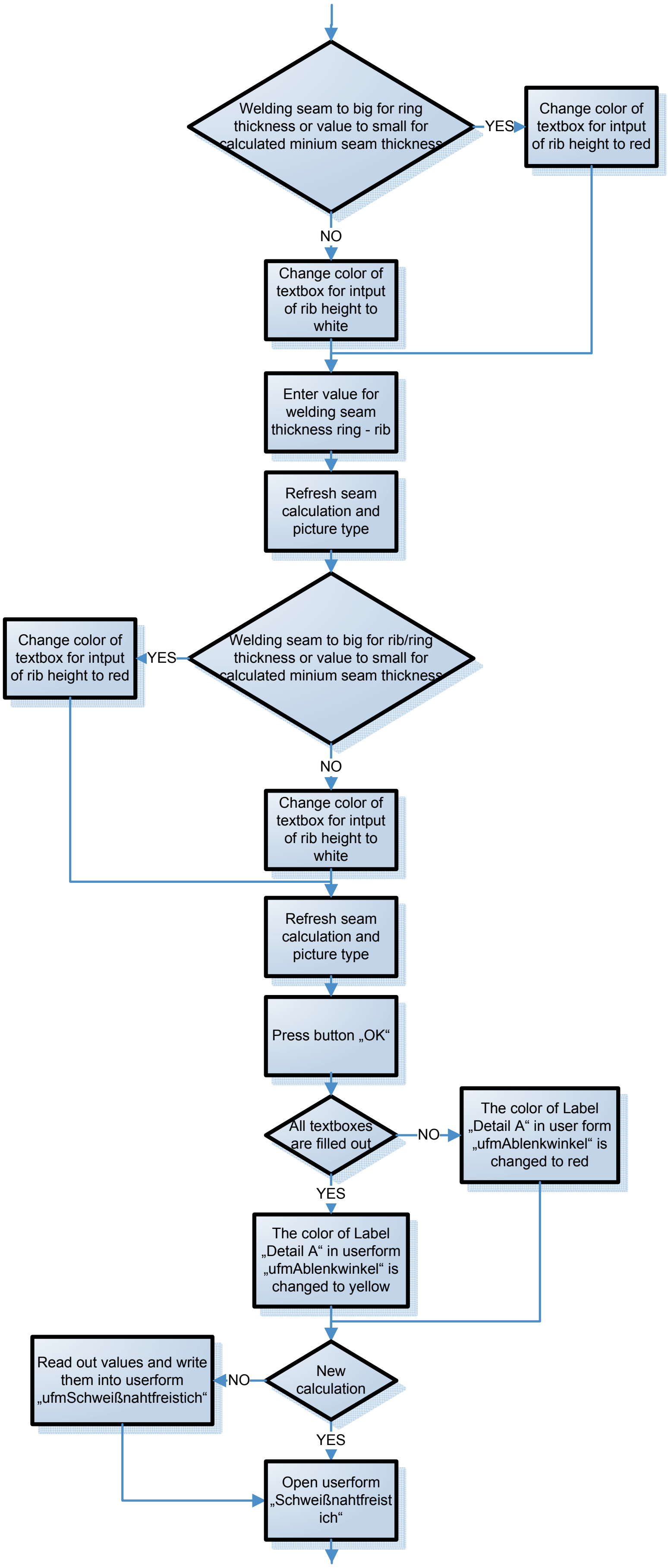
Picture 3-19: Entering the geometrical parameters for the ribs and the ring

After the last geometrical parameter has been entered (amount of ribs) the thicknesses of the welding seams can be calculated.



Picture 3-20: Entering the values for the welding seams, Part1

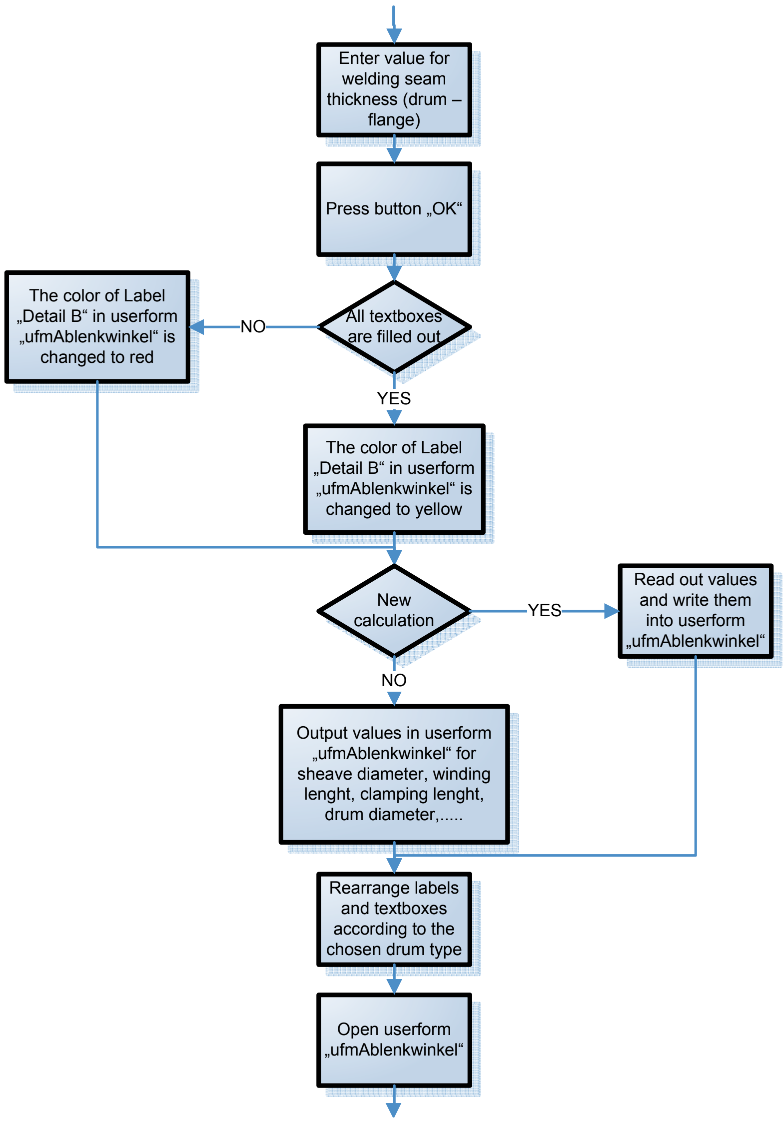
For the purpose of clarification, the Textboxes, to enter the welding seam thicknesses, are only shown now (They are not visible before). If all the necessary parameters have been entered, the minimum welding seam thicknesses are shown in the input mask. Otherwise a message appears which says so. Now every time a welding seam thickness is entered the program checks the kind of seam (K – seam, DHY – seam or throat seam) and changes the picture accordingly. It also checks if the entered value is valid or not and changes the color of the Textbox (not valid → red, valid → white).



Picture 3-21: Entering the values for the welding seams, Part2

After the last welding seam has been entered and validated, the user has to press the button “OK”. If then all the Textboxes are filled out, the color of the label “Detail A” in the input mask “ufmAblenkwinkel” is set to yellow, otherwise to red. The next program step opens the input mask “ufmSchweißnahtfreistich”.

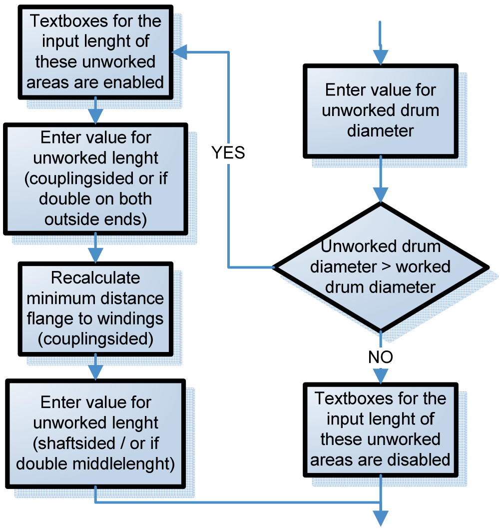
3.2.9 Welding seam preparation



Picture 3-22: Welding seam preparation

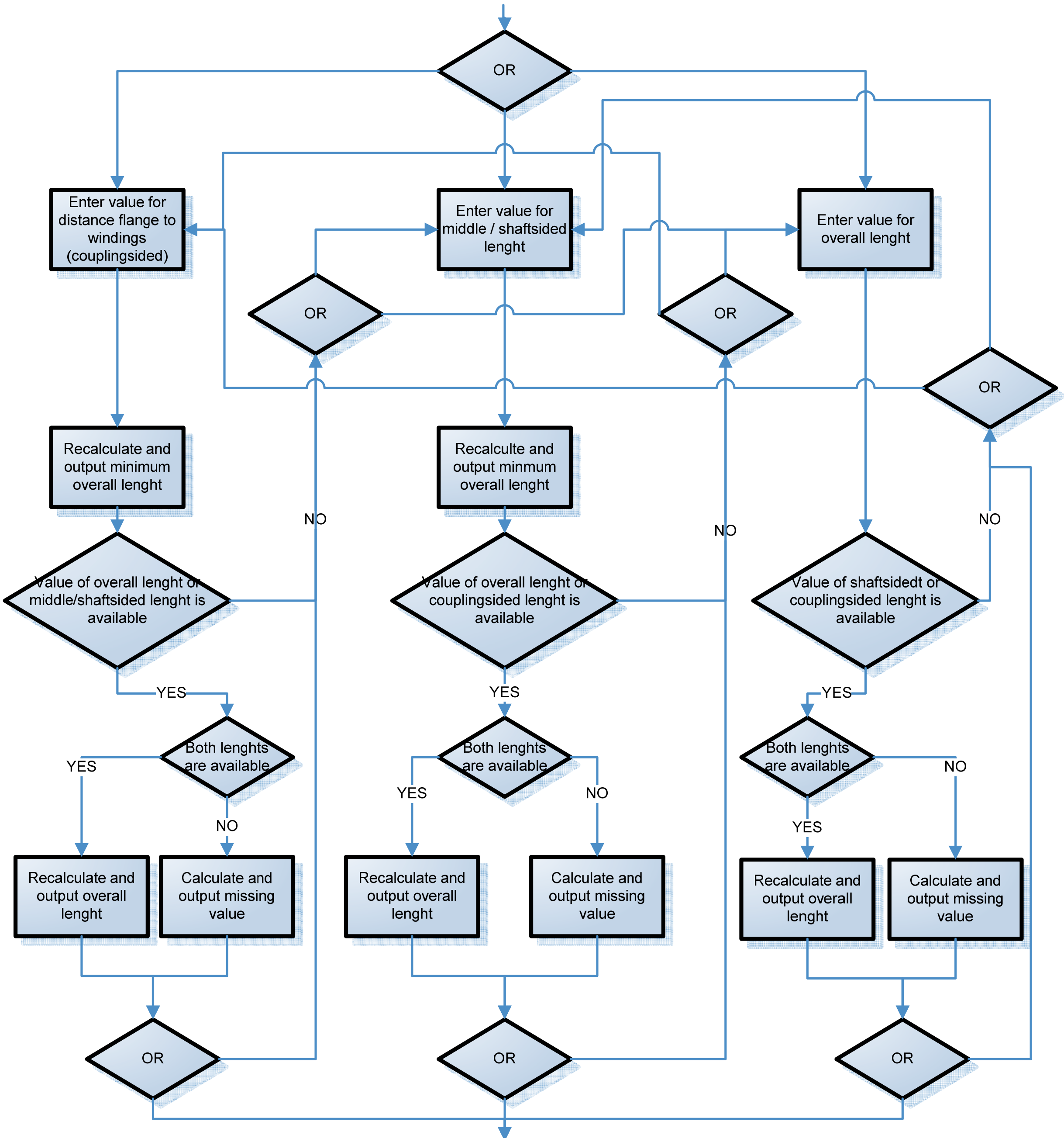
In this input mask just the thickness of the welding seam has to be entered, but if necessary, every other parameter that is already existing (e.g., drum thickness, flanged wheel shoulder width, length of the welding seam notch...) can still be changed. If then all the Textboxes are filled out, the color of the label “Detail B” in the input mask “ufmAblenkwinkel” is set to yellow, otherwise to red. Now, because of the different schematic pictures that illustrate the drum types, the labels and Textboxes are rearranged accordingly in the input mask “ufmAblenkwinkel” which is opened afterwards.

3.2.10 Main dimensions



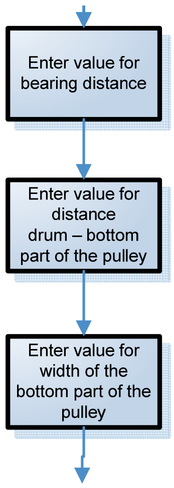
Picture 3-23: Input of values for unworked areas

The first thing after this input mask appears is to enter the diameter for eventually unworked areas on the mantle of the drum. If this entered value is higher than the diameter of the lowest point of the grooves (value shown in the input mask), Textboxes to enter the length of these areas, are enabled. Meaning, if some parts of the drum are not turned, these values would be the appropriate diameter and lengths. Otherwise the Textboxes are disabled, so that no values can be entered.



Picture 3-24: Parameters for overall length and corresponding middle lengths

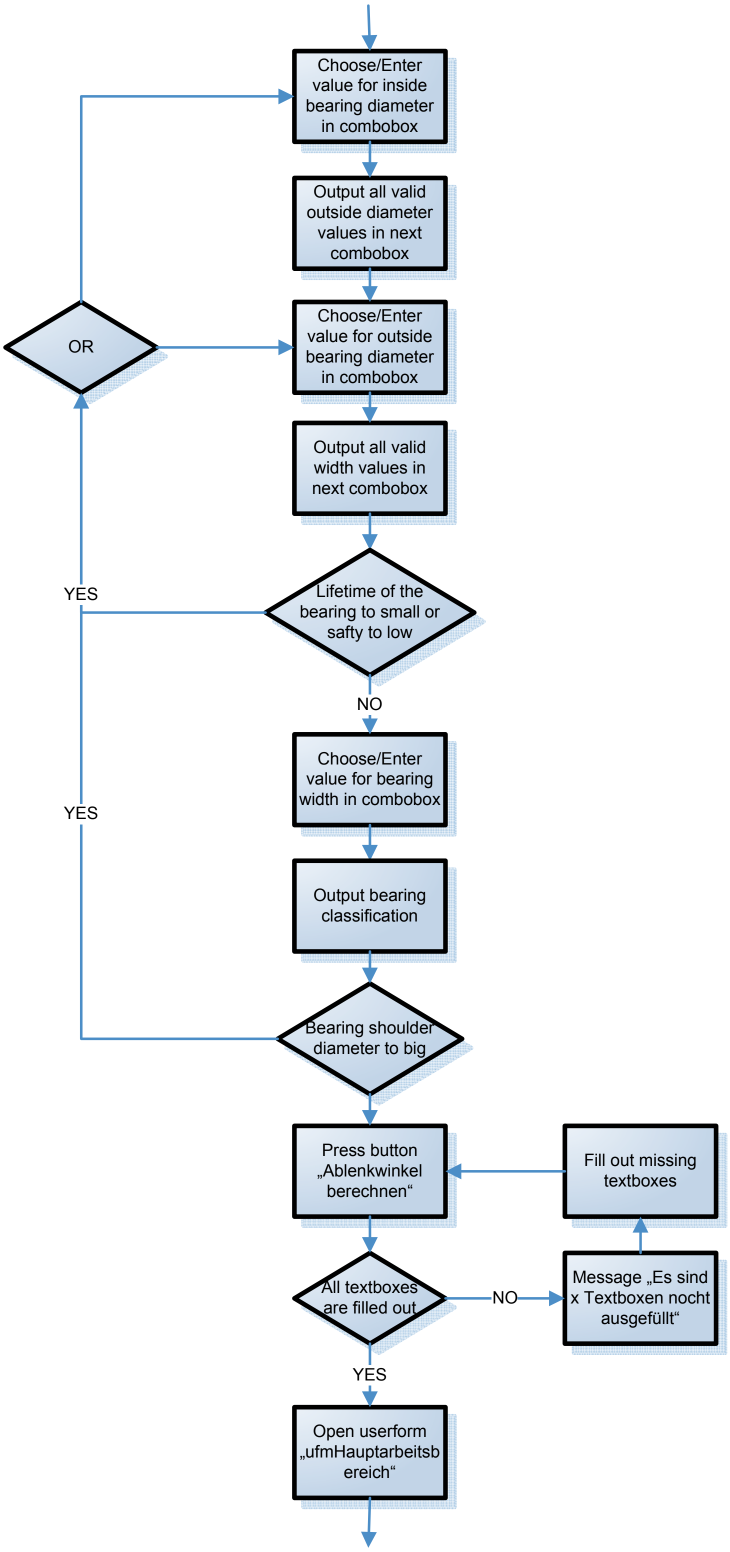
Now three possibilities are to the user's disposal, either he / she enters the overall length, the distance of the coupling sided flanged wheel to the windings or the middle length (Double drum) / distance shaft sided flanged wheel to windings (Single drum). For a picture of the input mask look at Picture 4-15 on page108. Depending on which two parameters are entered first, the third one is calculated and written into the third Textbox (If the values are not to the user's satisfaction, they can be changed at any time). In some cases, depending on the drum type, one of the values is already fixed. (Fixed value in case of flanged wheel clamping for the distance of the flanged wheel to the windings).



Picture 3-25: Parameters for the calculation of the deflecting angle

The next few values just serve the purpose to calculate the deflecting angle of the cable to the grooves and have no influence on the drum geometry itself.

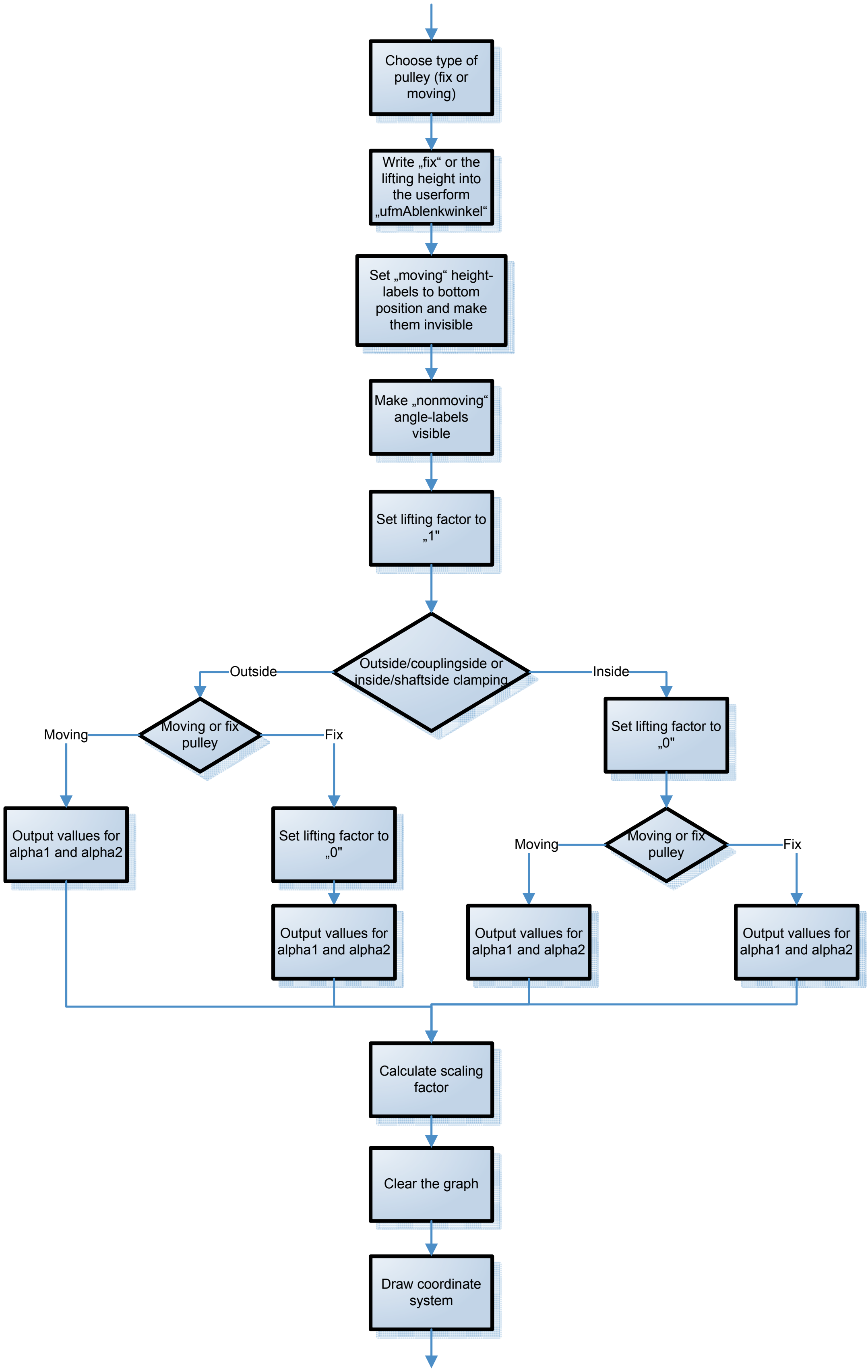
3.2.11 Self aligning roller bearing selection



Picture 3-26: Self aligning roller bearing selection

The following steps help selecting the roller bearing. By choosing the inner diameter of the bearing, in the first Combo box, all the outside diameters, that can be chosen, are written accordingly into the next Combo box. By then choosing the outside diameter of the bearing all the possible widths, along with the lifetime and the safety, are written in the third Combo box. Now, if one of the bearings fits the demands of the user, the width can be chosen and thereby the classification of the bearing is written into a label next to the Combo box, otherwise one can change the inside or outside diameter and search for a better fit. The next step is to calculate the deflecting angle of the cable. For this the button "Ablenkwinkel berechnen" (calculate deflecting angle) has to be pressed. If then all the necessary values are filled out, the program opens the next input mask "ufmHauptarbeitsbereich" (ufm main working area), otherwise a message appears telling the user to enter the missing values.

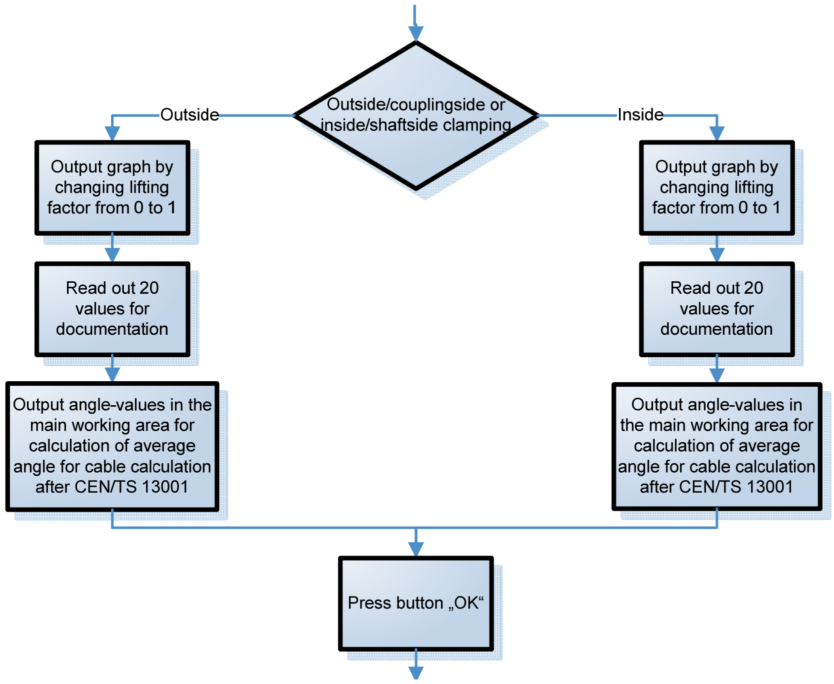
3.2.12 Calculating the deflecting angle



Picture 3-27: Calculate top and bottom deflecting angle

In this mask the user now has to choose if the bottom part of the pulley is moving up and down along with the load or there is no pulley and the cable is just turned around a sheave. After this ether the value of the lifting height or the term “fix” is written into a label in the input mask “ufmAblenkwinkel” next to the dimensioning of it. The next steps just move the labels aside so that they don’t disturb the refreshing of the deflecting angle. Depending on the drum and pulley type the values for the deflecting angle in the top and bottom position of the load are shown. These values also serve the purpose of scaling the graph of the deflecting angle (See Picture 4-18 on page 112).

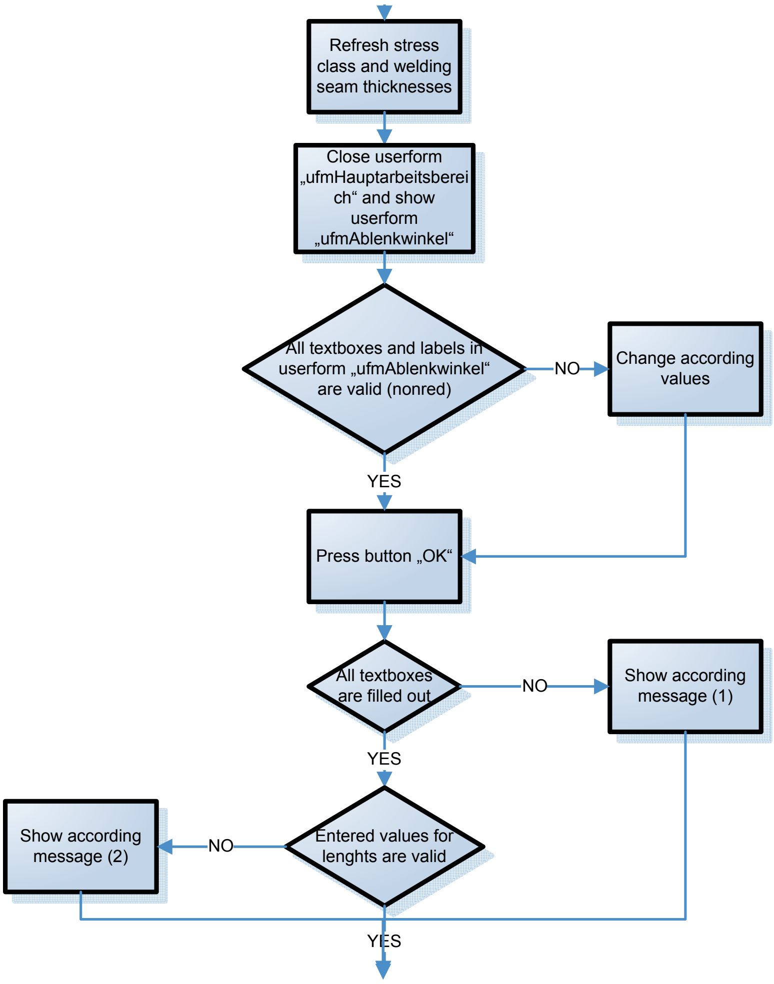
Clearing the graph happens in that way that a rectangle filled with white dots is oversubscribing the area where the graph later is drawn. After this the coordinate system is drawn in the mask (Two black axes, horizontal axis → deflecting angle, vertical axis → load height).



Picture 3-28: Draw deflecting angle

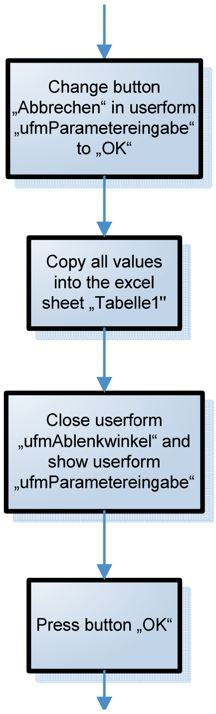
Depending on the drum type, the deflecting angle is calculated in different fields of the Excel sheet. Now by changing the lifting factor from zero to one in thousandth steps the graph is drawn. Each step draws a dot on the mask and depending on the value of the angle the dot has a different color (green → lower than 1 degree, yellow → lower than 2.5 degree, red → higher than 2.5 degree). In the course of this, twenty values are read out to draw the deflecting angle in the excel sheet “Hauptteil” for documentation purposes. Also, but only for the main working area, values are read out to calculate the average deflecting angle which is necessary for the calculation of the cable diameter according to CEN/TS 13001 – 3. The main working area can be shown by pressing the button “Hauptarbeitsbereich eintragen” (enter main working area) in the input mask. If the main working area is not defined yet, then it can be made up for by pressing the left mouse button in the input mask where the graph is drawn (first the lower distance then the bigger distance from the top position). In case the course of the deflecting angle is not satisfying, the geometric values of the drum can still be changed (e.g., drum diameter, overall drum length, distances of the windings to the flanged wheels...). Otherwise the calculation of the whole drum is now finished.

3.2.13 Ending the calculation



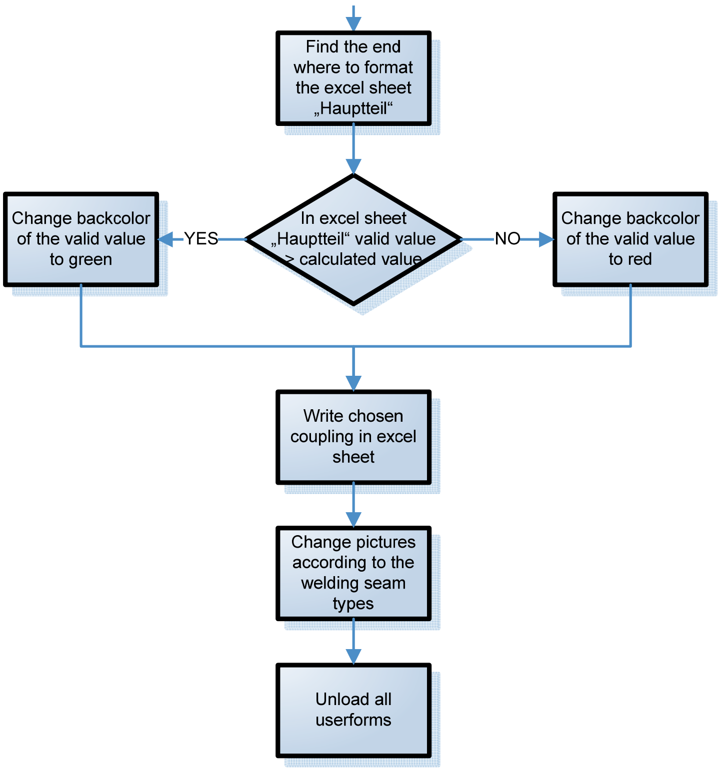
Picture 3-29: Ending the calculation, Part1

By closing the input mask, the program updates the stress class and in the same move, the minimum welding seam thicknesses, just in case the main working area has been changed. Now the input mask “ufmAblenkwinkel” has to be validated by pressing the button “OK”. If undeliberately not all values have been entered the program shows a message saying so, also if some values have been entered wrong (e.g., to short overall length) the program shows a message accordingly.



Picture 3-30: Ending the calculation, Part2

Either way, the input mask is closed and the mask “ufmParametereingabe” reappears. But before that, the button „Abbrechen“ (Abort) is changed to „OK“ and all input parameters are copied to the excel sheet “Tabelle1”. There, if no changes want to be made anymore, the user has to press the button “OK” to finally finish the calculation.



Picture 3-31: Ending the calculation, Part3

This event triggers the last formatting changes in the excel sheet “Hauptteil”. These are:

1. Change the back color of the cells according to their valiancy. Meaning if for example the entered welding seam thickness is higher than the calculated minimum thickness, the back color is changed to green otherwise to red. But this doesn’t implicitly happen for the whole sheet (if the calculation of the cable diameter according to CEN/TS 13001 – 3 is not made, this part doesn’t get formatted).
2. The designation of the chosen coupling size is copied into the excel sheet.
3. The pictures of the welding seam types are changed accordingly (K – seam, DHY – seam or throat seam).

Afterwards all user forms are unloaded and the excel sheet “Hauptteil” is shown. There the last manual changes can be made (Enter descriptive text).

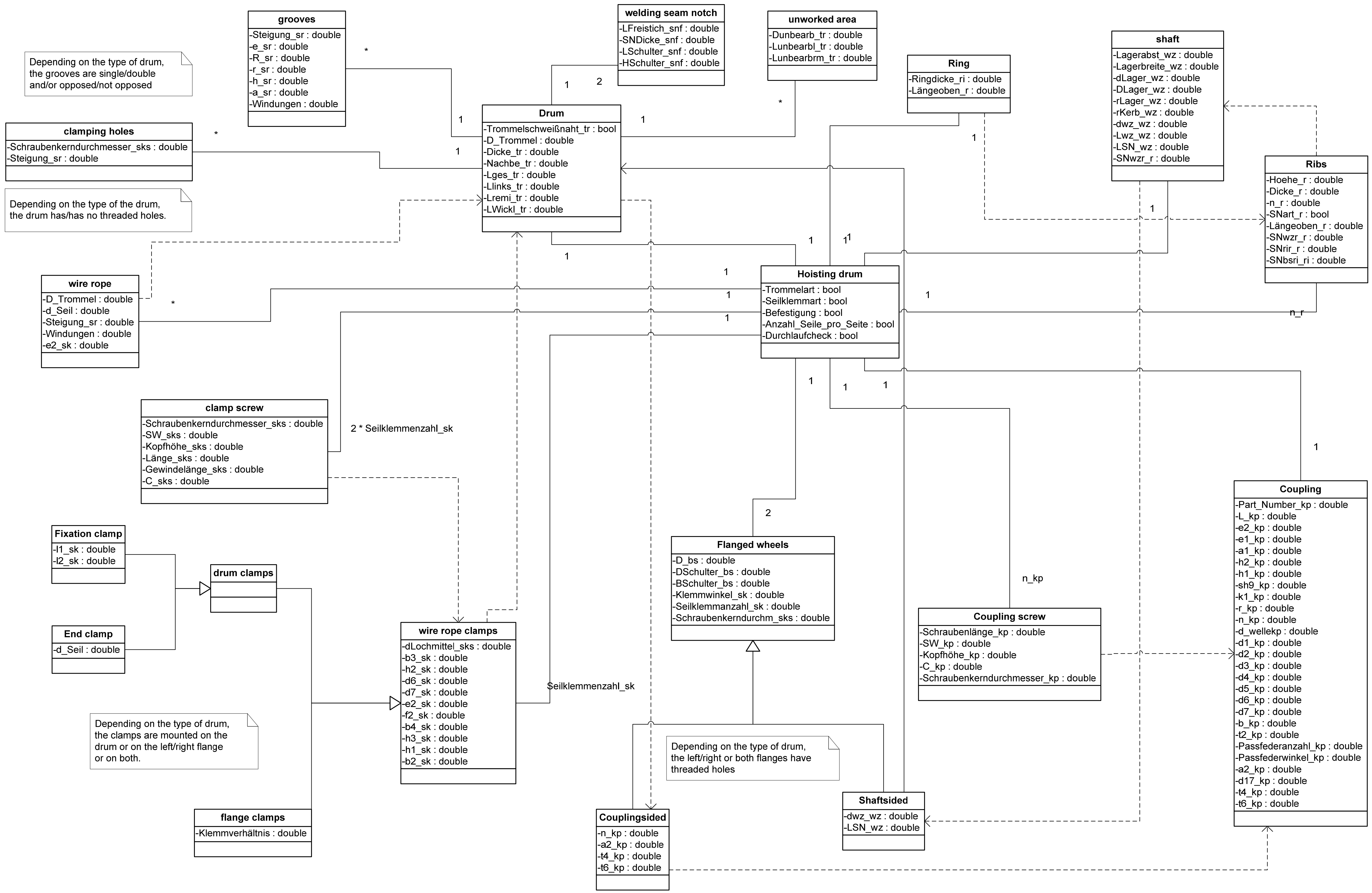
Now, to make this new calculation valid for the 3D – drawing, the file has to be saved.

3.3 Transition from the calculation to the 3D drawing

Now that all the parameters, which determine the 3D – model, are calculated and saved in the Excel sheet “Tabelle1”, the file “Seiltrommel.iam” can be opened with Inventor. The next steps to finish the construction/update the model are to press the button “Aktualisieren” (Refresh) and then afterwards the button “itrigger” in the tab “iLogic” in the sidebar of Inventor. The first event updates all geometric values (e.g., diameters, lengths...), the second one updates the drum type by suppressing/unsuppressing parts and features (e.g., cable clamps, boreholes...).

In the next chapters the modeling of the drum and the connections of the parameters are described in detail.

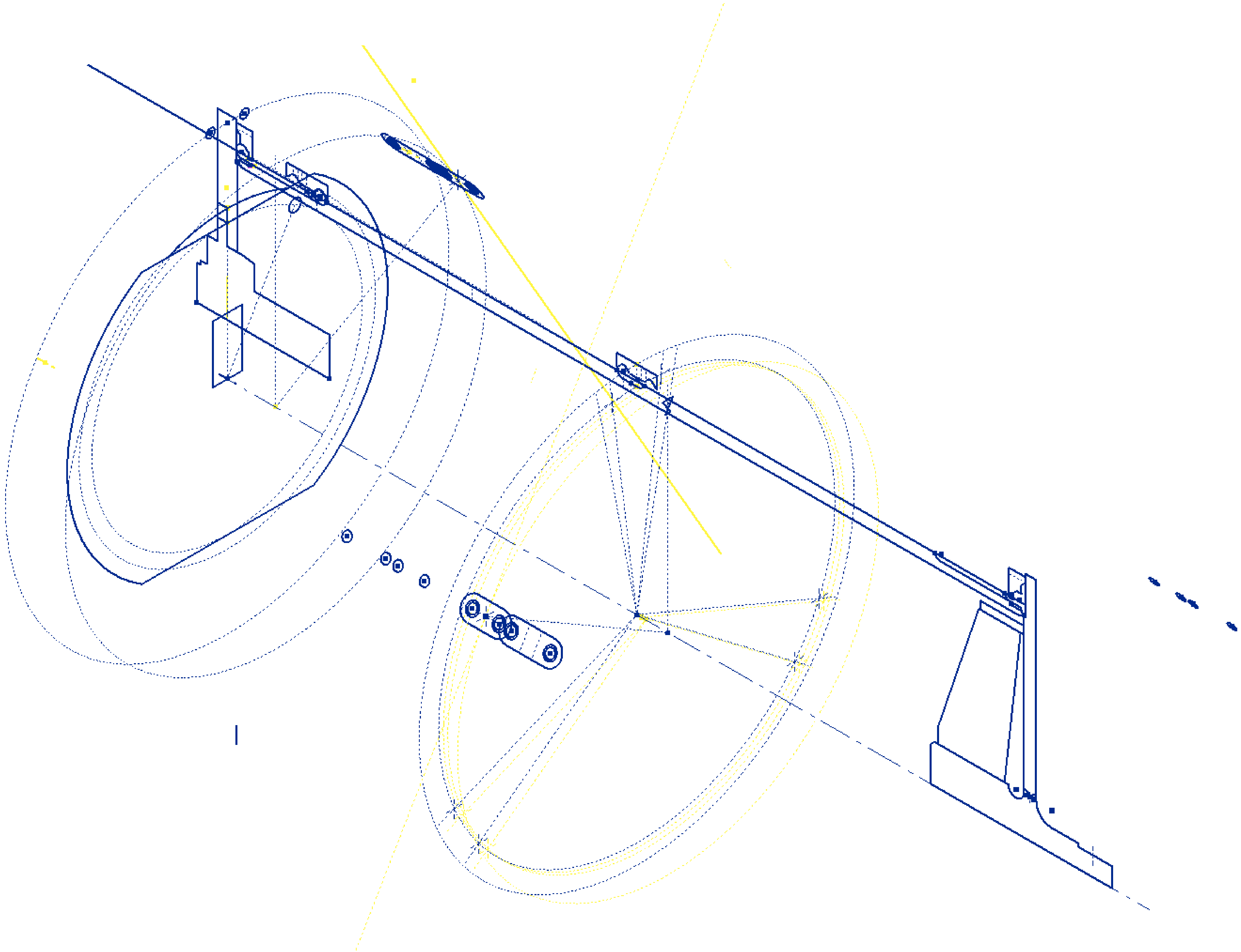
3.3.1 Handover of the parameters



Picture 3-32: Connections of the steering parameters in Inventor

The diagram above describes on the one hand which parameter in the Excel sheet “Tabelle1” controls which part of the drum and also which type they are (Double or Boolean).

3.3.2 Making of the drafts for the part modeling



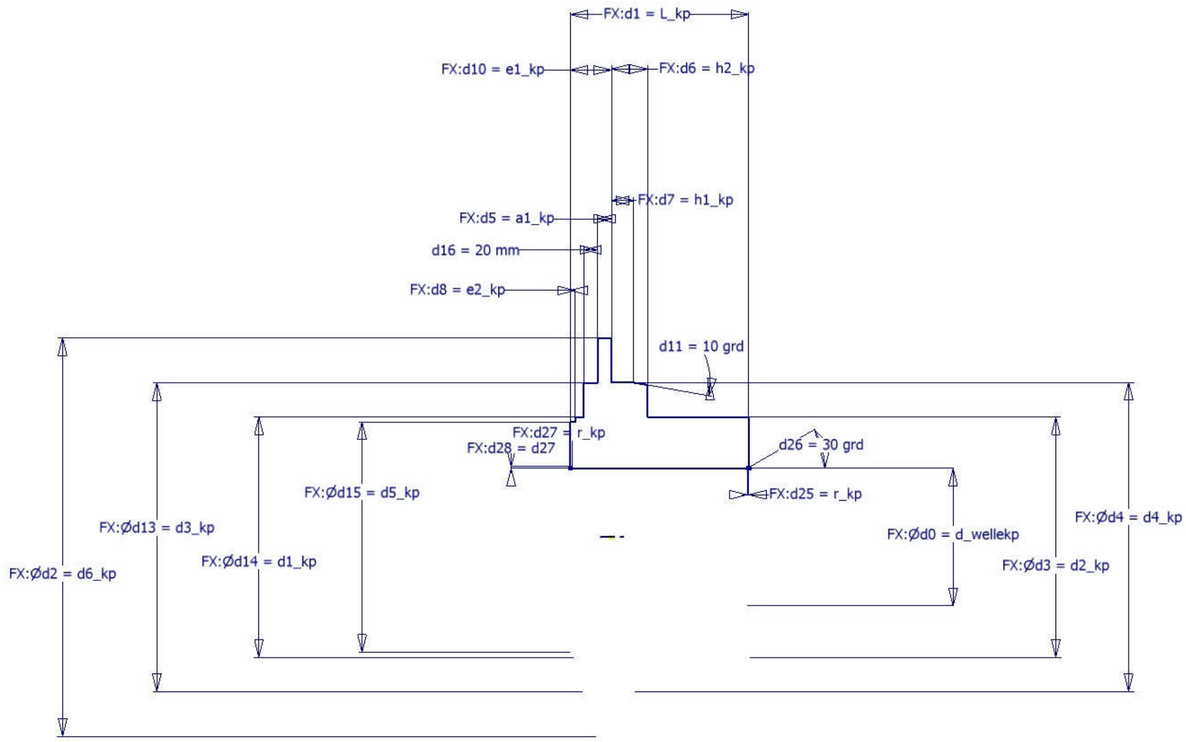
Picture 3-33: Totality of all drafts

The company's internal prerequisite of drawing a 3D model is to first draw a draft of the whole drum including every drilled hole, chamfer and rounding, so that afterwards an engineer can, if necessary, remodel the object without intensive retracing of the modeling steps. After all the drafts are made, modeling the parts in 3D is not very time consuming anymore. For the single parts the specific drafts and parameters of the layout file are linked to the new file. So that if changes have to be made, just the layout file has to be changed. The following chapters show how the parameters in Picture 3-32 were applied to the drafts in Picture 3-33 in the order they were drawn, starting with the coupling on the left side of the picture.

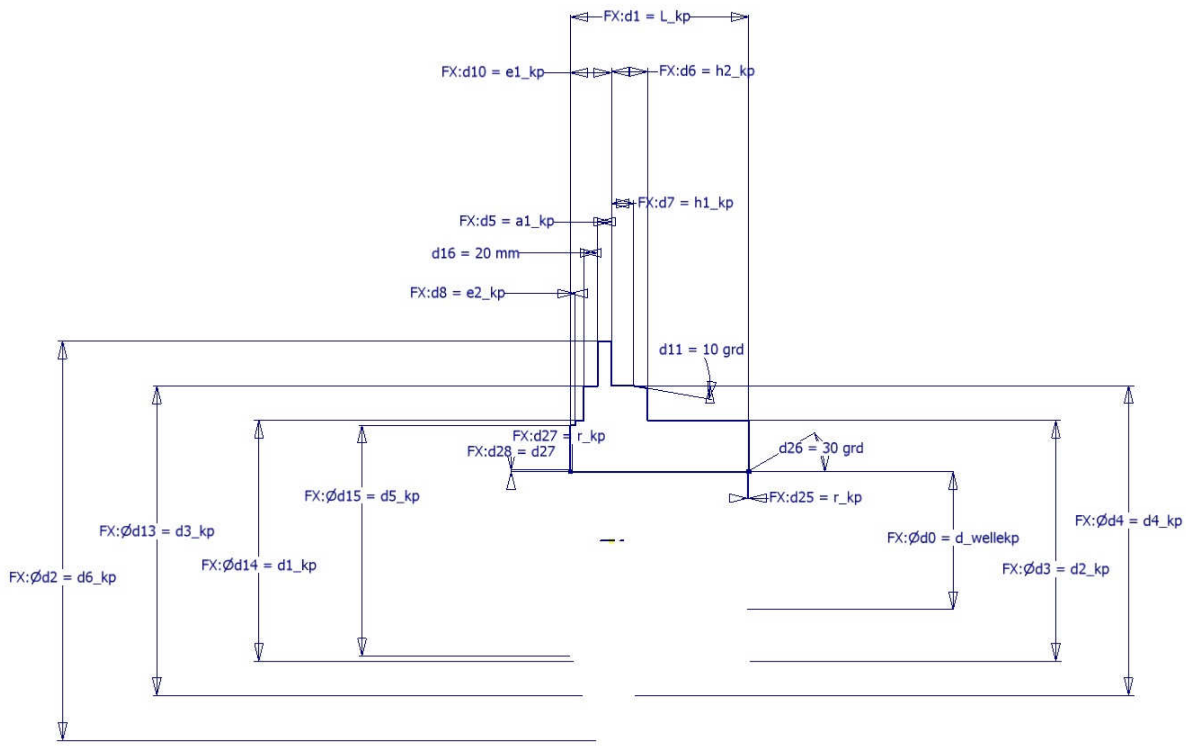
Picture 3-34: double drum with outside drum clamping and one parallel cable

Picture 3-34 shows the finished drum according to the parameters (in this picture just one cable is visible, in order to be able to see the cable grooves on the drum).

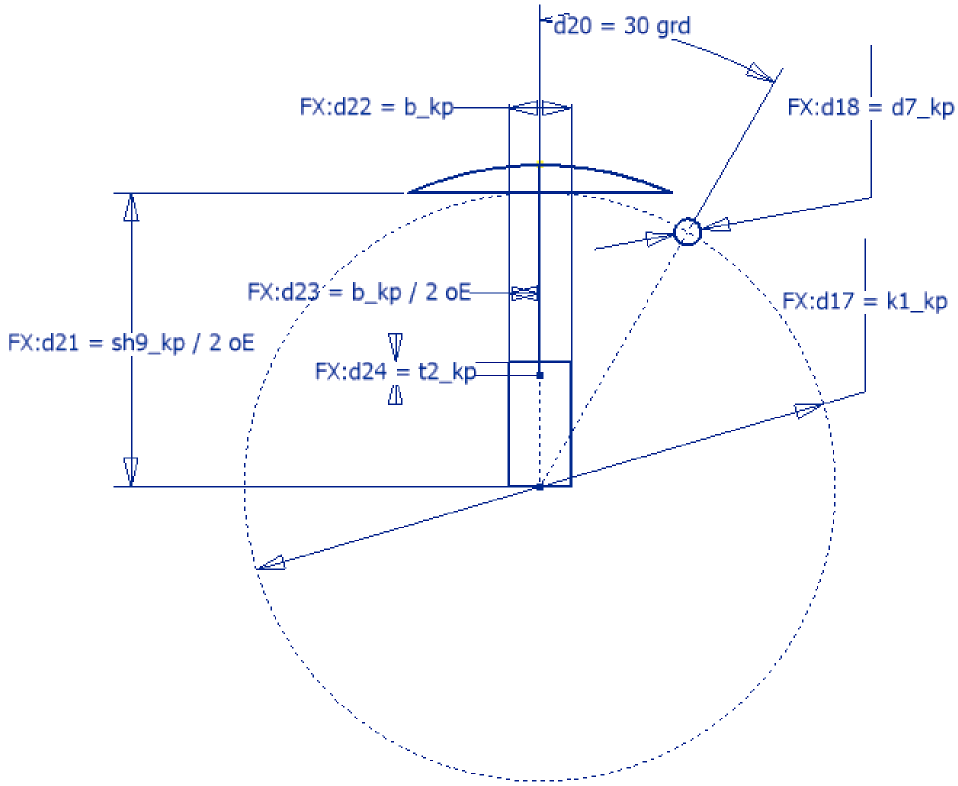
3.3.2.1 The coupling



Picture 3-35: Coupling, diameters and lengths



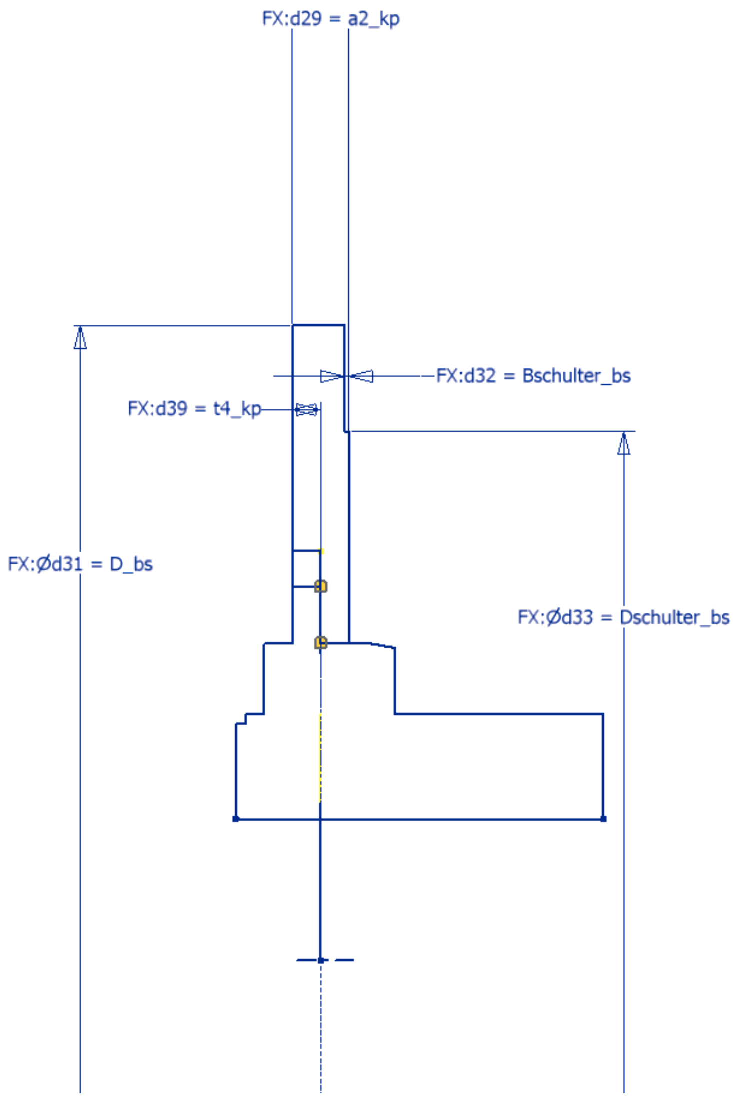
Picture 3-35 shows how the diameters and lengths of the coupling are applied (The line and the dot in the middle represent the rotational axis). As seen in the same picture at the dimensioning d11, d16 and d26, not all values change with the coupling sizes.



Picture 3-36: Coupling; drilled holes, key and milling

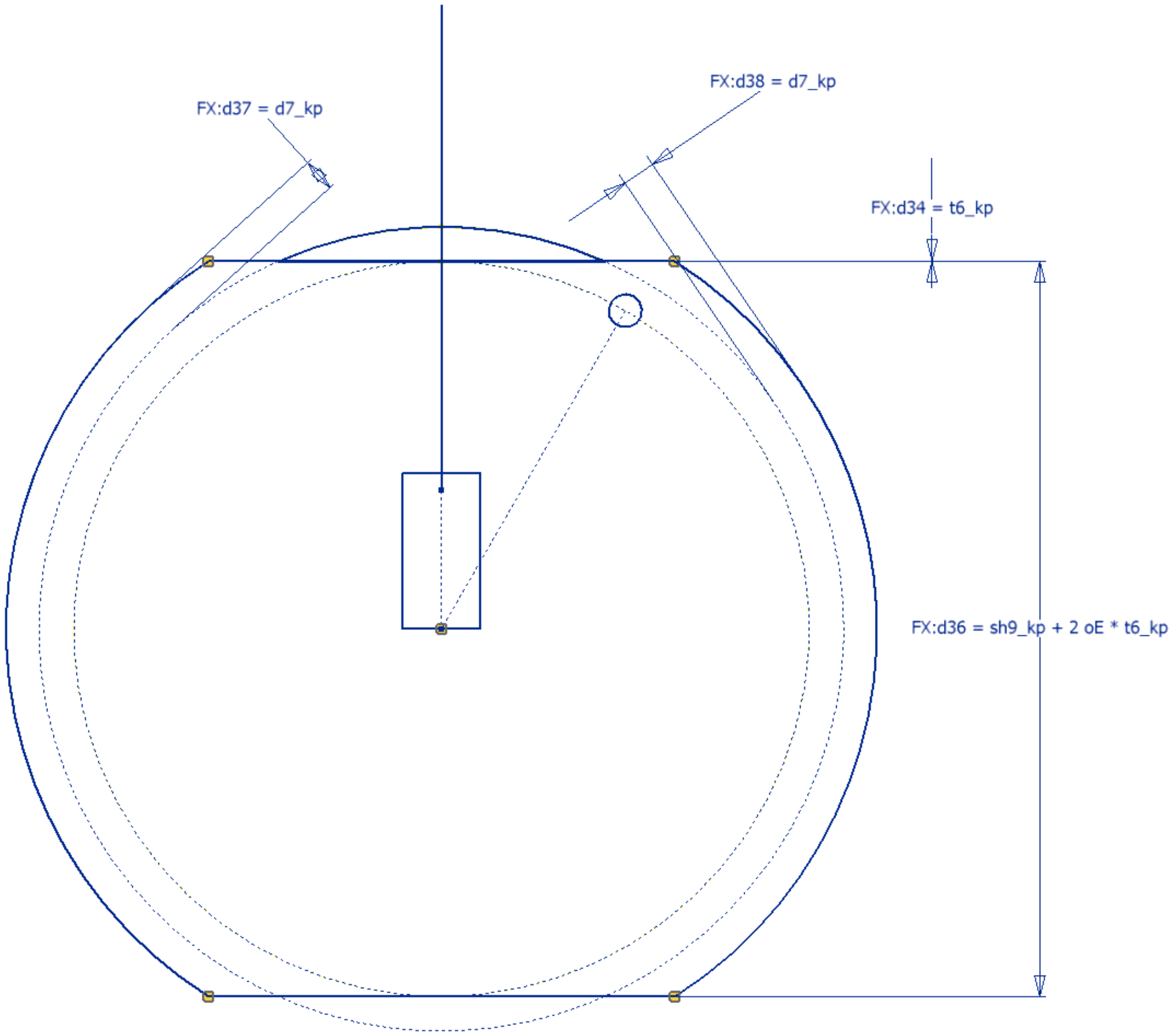
Picture 3-36 shows the first position of the drilled holes of the coupling to the flanged wheel. In a following step they are duplicated according to the parameters. The same happens to the key.

3.3.2.2 The coupling – sided flanged wheel



Picture 3-37: coupling – sided flanged wheel, diameters and lengths

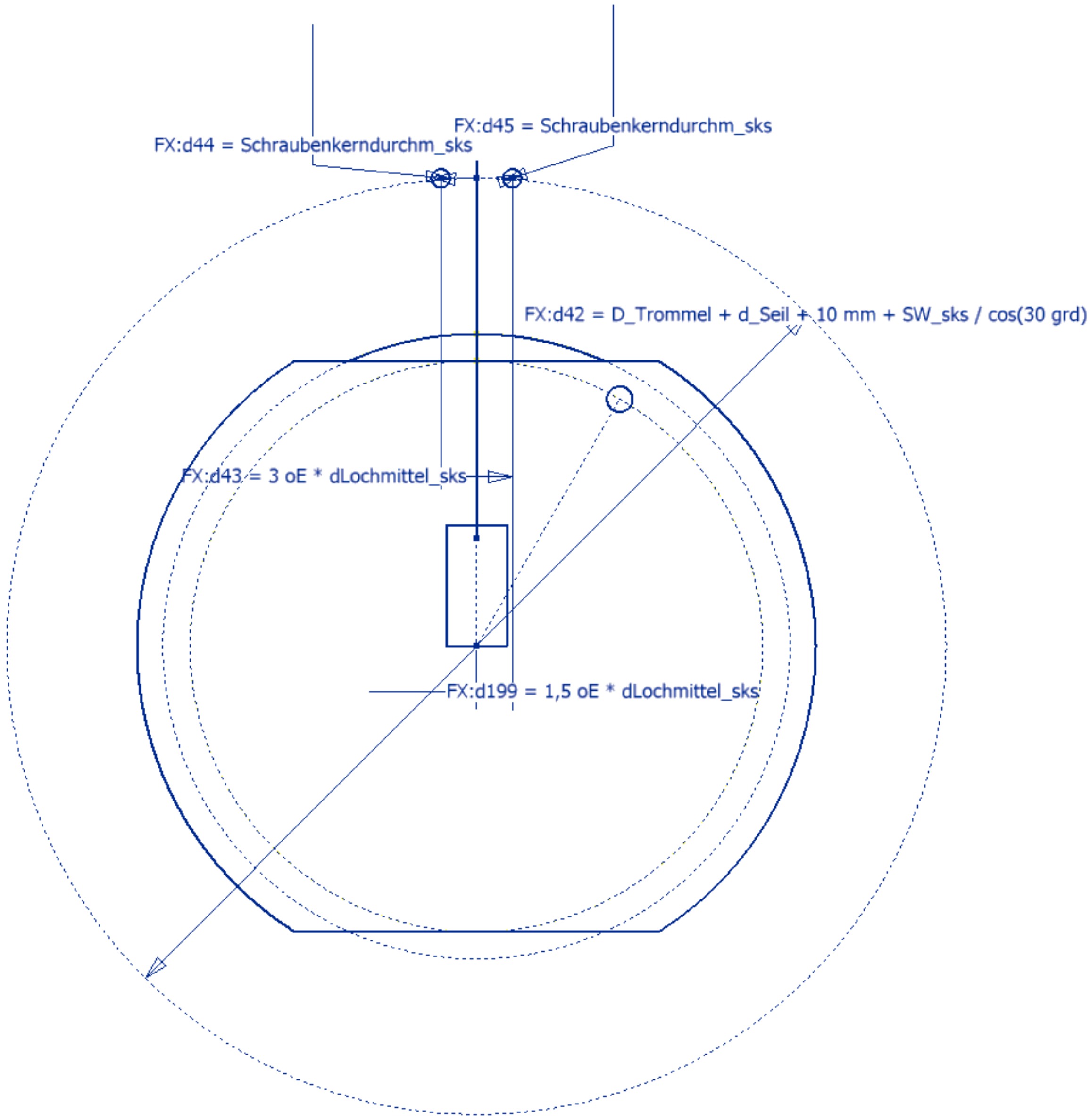
As apparent in Picture 3-37 not every value for the flanged wheel has to be drawn because some of them are already applied in the coupling (e.g., inside diameter of the flanged wheel). The grading on the right side of the flanged wheel is the shoulder for the welding seam preparation. This is where the drum and the flanged wheel are welded together.



Picture 3-38: coupling - sided flanged wheel, milling

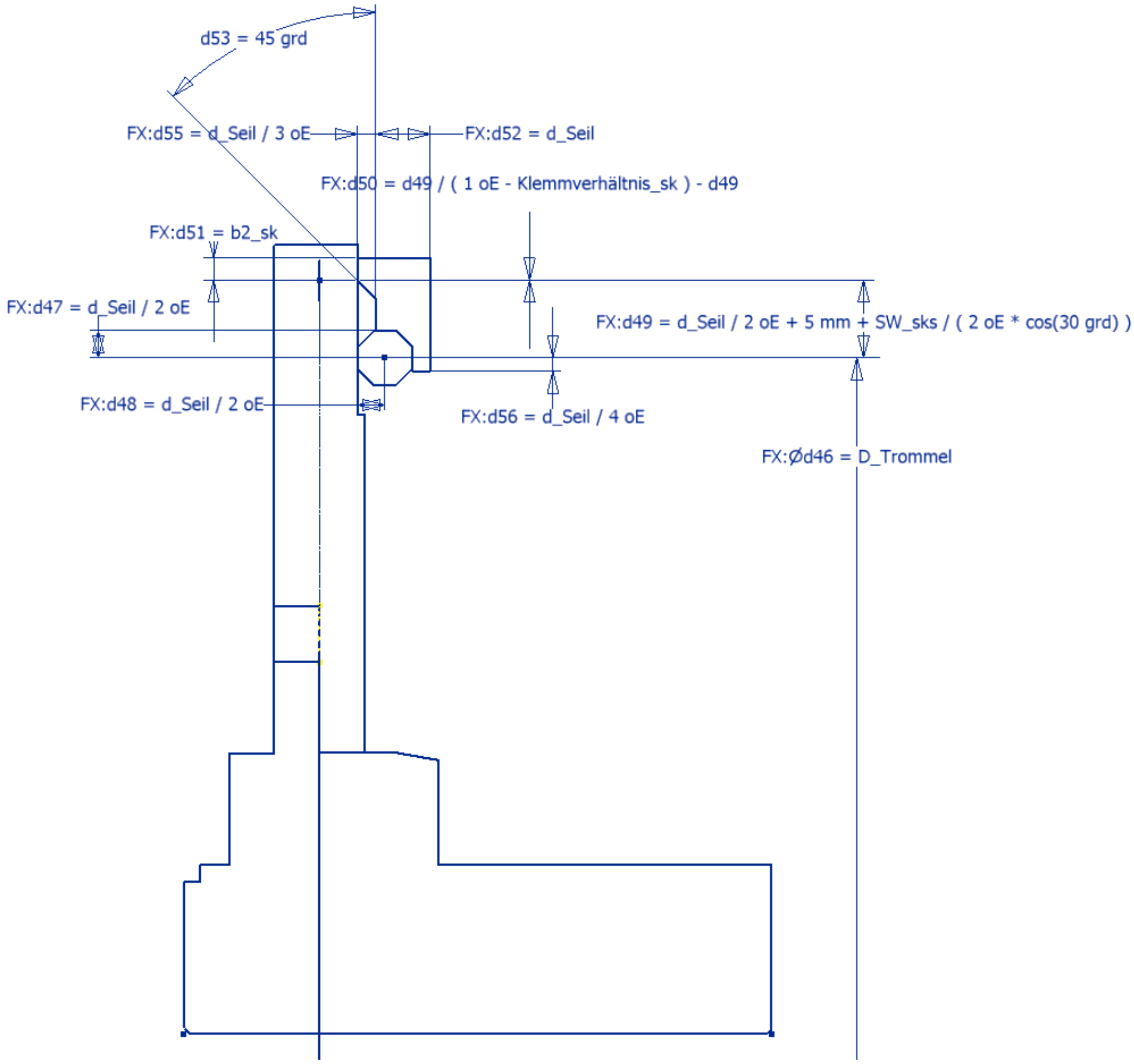
The value FX:d36 in Picture 3-38 shows that it is also possible to write small equations in the dimensioning (It is somehow obvious that a whole hoisting drum can't be modeled with only 105 parameters; they are just the main determining ones). This draft is for the milling of the locating mask of the flanged wheel to the coupling (The value t6_kp is a tolerance).

The following draft is for the drilling of the holes if the cable is clamped on the flanged wheel (The draft still exists even if the holes are not necessary for the current version of the drum).



Picture 3-39: coupling - sided flanged wheel, drilled holes

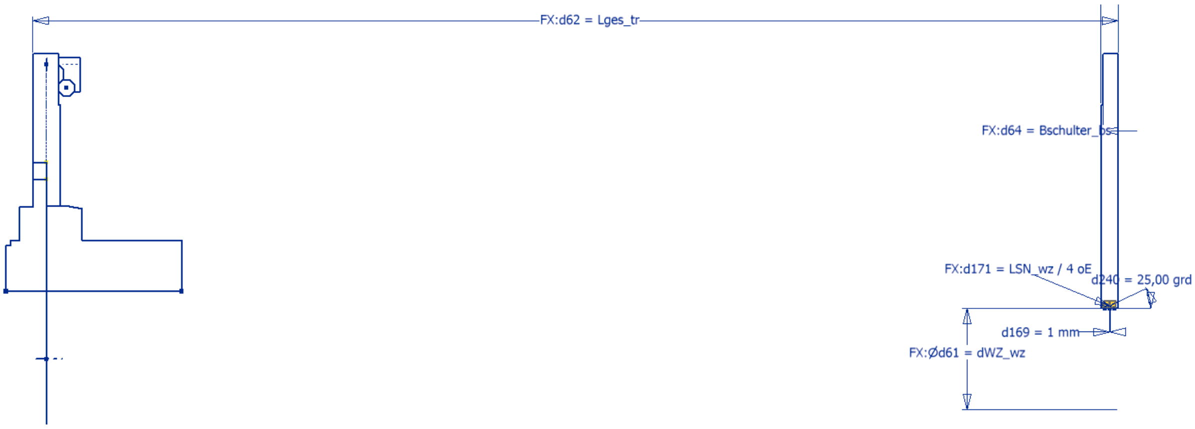
3.3.2.3 Flanged wheel cable clamps



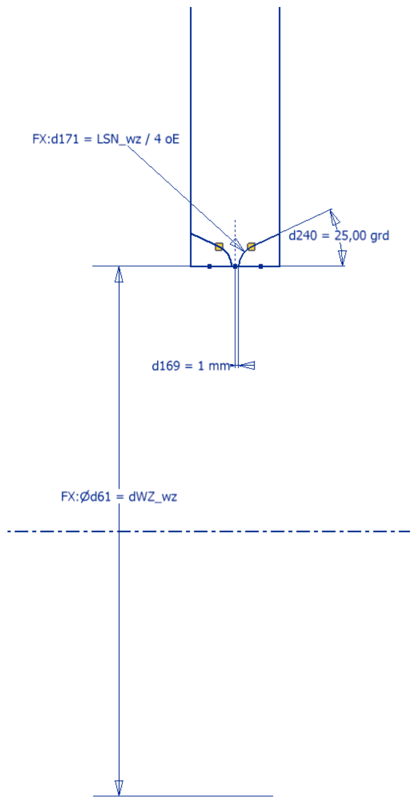
Picture 3-40: Flanged wheel cable clamps

After the flanged wheel is finished the cable clamps are modeled. In this case the value for the dimension FX:d50, which contains the clamping ratio, is zero because the ratio itself is zero (In the case of flanged wheel clamping, the ratio should not be lower than 0.5). The octagon represents the diameter of the cable and where it is clamped. As apparent in this picture there are just two surfaces which clench the cable. The other surfaces (edges) of the octagon have no influence on that because the cable wraps around the drum and the clamps are straight. In a later step this draft (Picture 3-40) is mirrored to the other side of the drum in order to model the clamps for the shaft – sided flanged wheel.

3.3.2.4 Shaft – sided flanged wheel



Picture 3-41: Distance of the flanged wheels

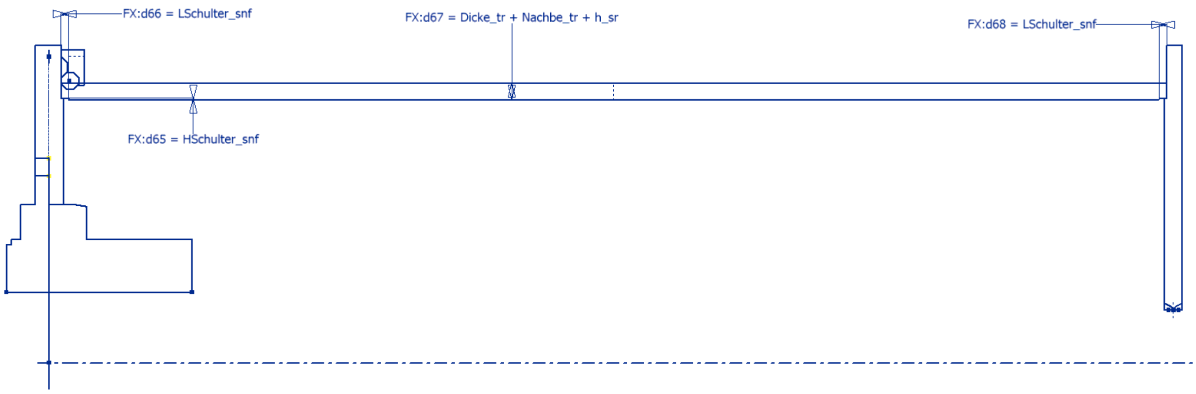


Picture 3-42: Detail of the shaft - sided flanged wheel

As evident in Picture 3-41 both flanged wheels look similar referring to the shoulder for the welding seam preparation.

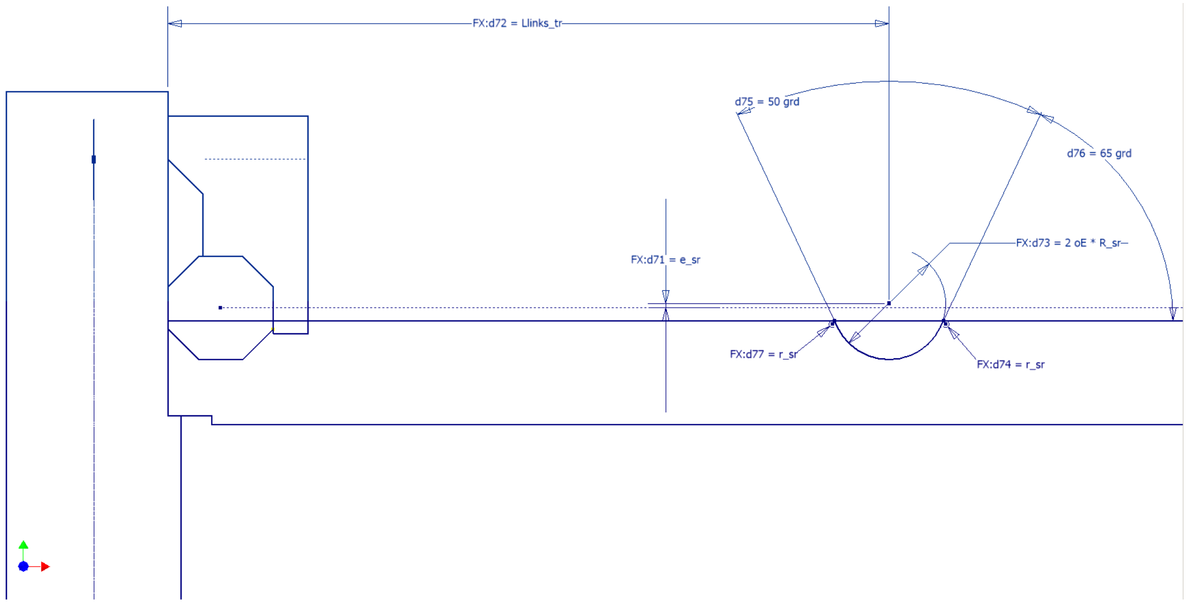
Picture 3-42 shows the welding seam preparation to connect the shaft with the flanged wheel. The bridge in the middle has a constant value of 2mm for a better centering of the shaft.

3.3.2.5 The drum



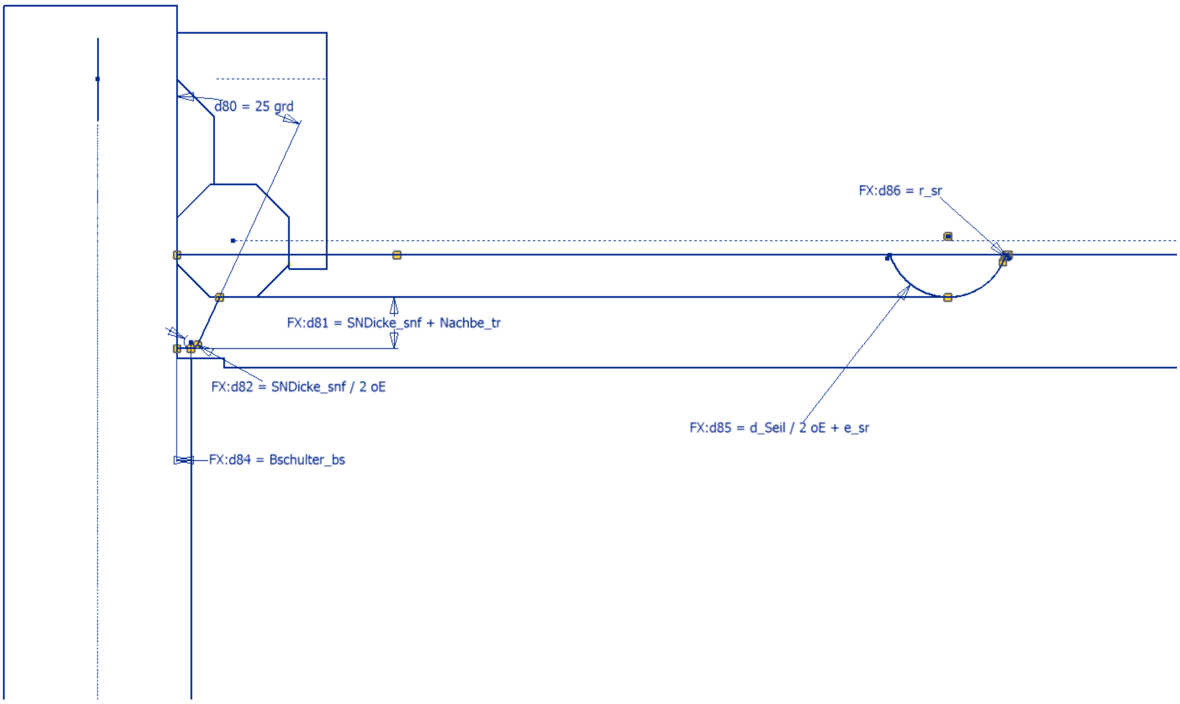
Picture 3-43: Drum modeling

The following step is to model the barrel of the drum where the cable is wrapped onto. The entire thickness is calculated by adding up the entered thickness, the post processing allowance and the height of the cable grooves. In the next steps the cable grooves and other notches reduce the thickness in some areas again.



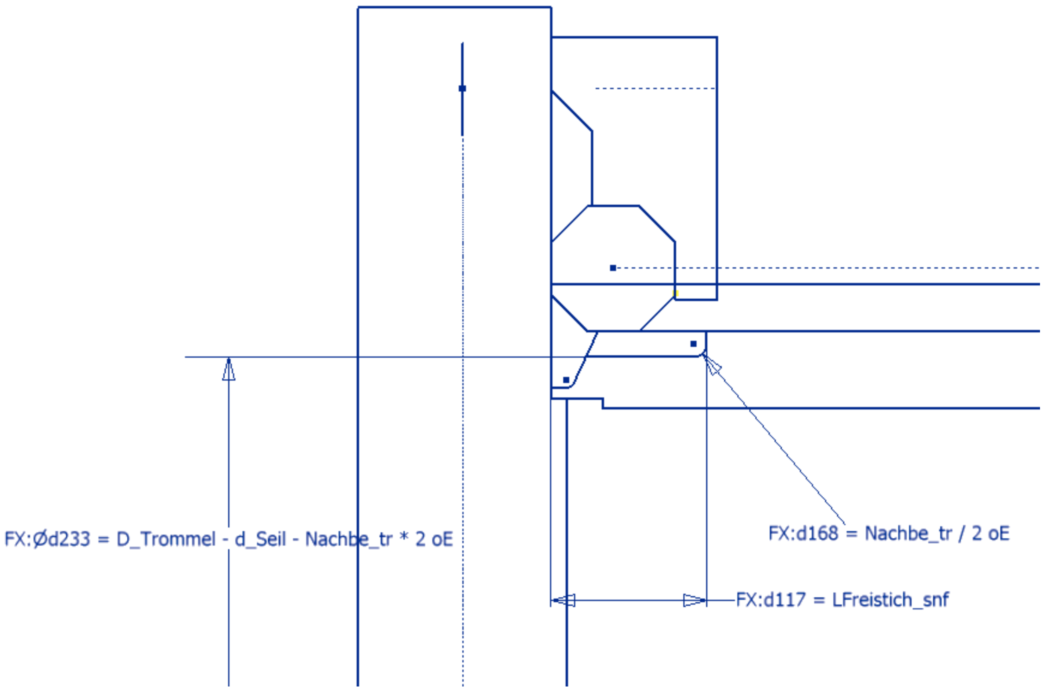
Picture 3-44: Modeling of the cable grooves

The parameter “Llinks_tr” defines the distance of the cable grooves to the flanged wheel on the side of the coupling. The minimum distance is defined by the space required of the cable clamps (Doesn’t matter which type).



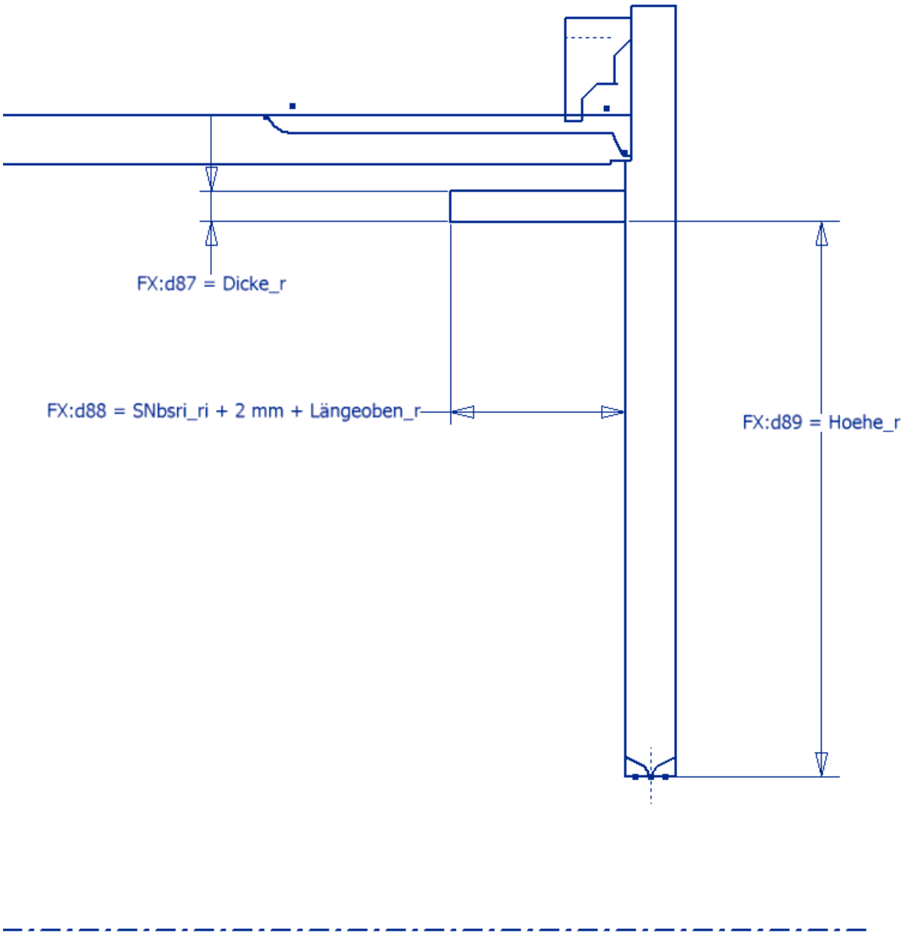
Picture 3-45: Welding seam preparation and lowering of drum thickness to real size

This notch reduces the drum thickness to its real size in this area and creates a part of the welding seam preparation. As evident in Picture 3-45 the other part of it (Picture 3-46) is only possible with drum clamping and cannot be applied with flanged wheel clamping.



Picture 3-46: Second part of the welding seam prep.

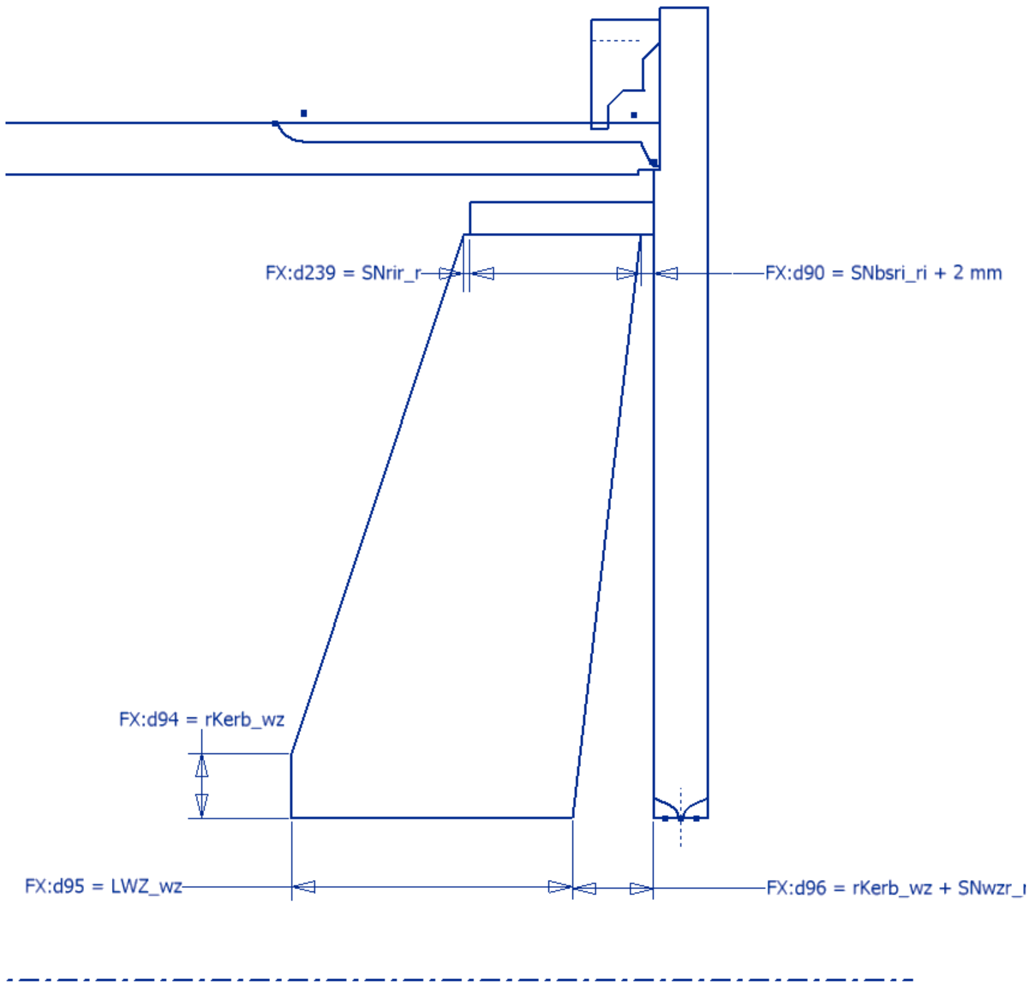
3.3.2.6 The ring



Picture 3-47: The ring

The dimension FX:d88 is put together by the parameter for the length of the welding seam (ring – ribs), the welding seam thickness (ring – flanged wheel) and a distance of 2mm so that the seam does not interfere with the ribs.

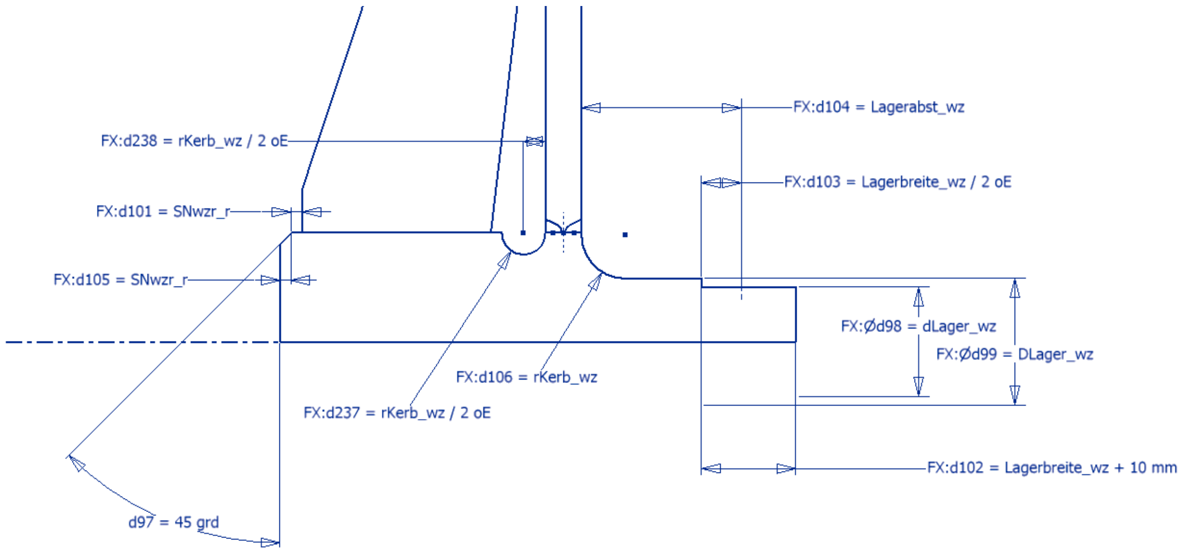
3.3.2.7 The ribs



Picture 3-48: The ribs

The length of the ribs on the top is put together by the same parameters as the ring. It is just a bit longer to make a better finish to the welding seam. Also the bottom of the ribs is in a distinct distance to the flanged wheel to make space for a relief notch in the shaft (“rKerb_wz”). The parameter “SNwzr_r” is for the same reason as “SNrir_r”, to make a better finish to the welding seam on the bottom.

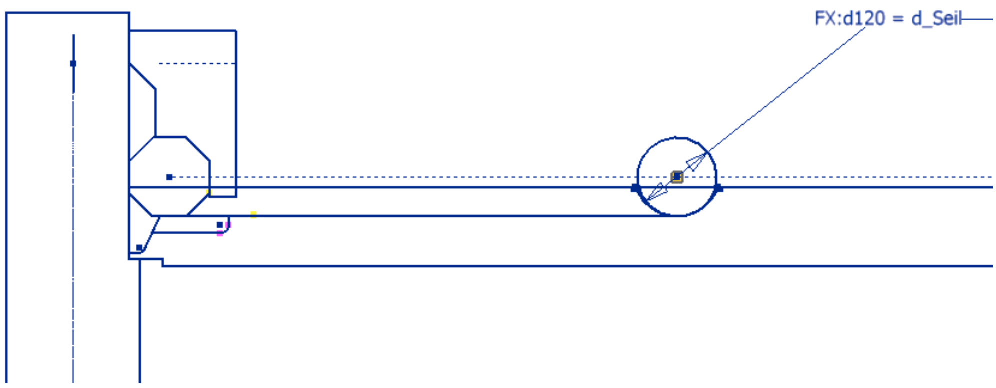
3.3.2.8 The shaft extension



Picture 3-49: The shaft extension

The shaft extension is pretty much already defined by the ribs and the flanged wheel. The only thing that is missing is the seat for the bearing. The parameters for the distance and the thickness of the bearing are defined anyway, but one thing, that is always somehow different, is the ending of the shaft extension. This is the only part that has to be designed by the user himself, due to the fact that there are so many variations of how to fix the bearing to the shaft.

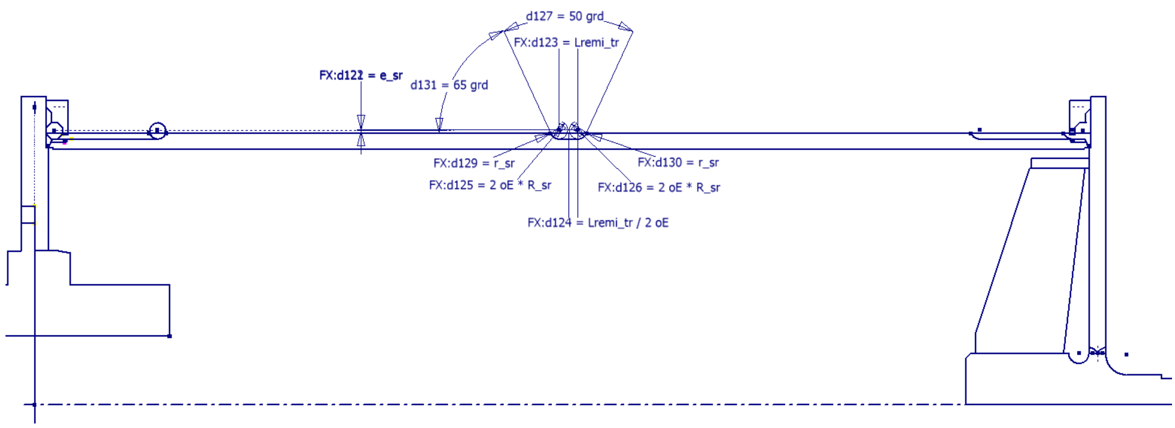
3.3.2.9 The cable



Picture 3-50: The cable

Designing the cable is nothing complex because the position of the cable is already given due to the windings. The diameter and the amount of the windings are two of the main parameters anyway.

3.3.2.10 Middle – notch



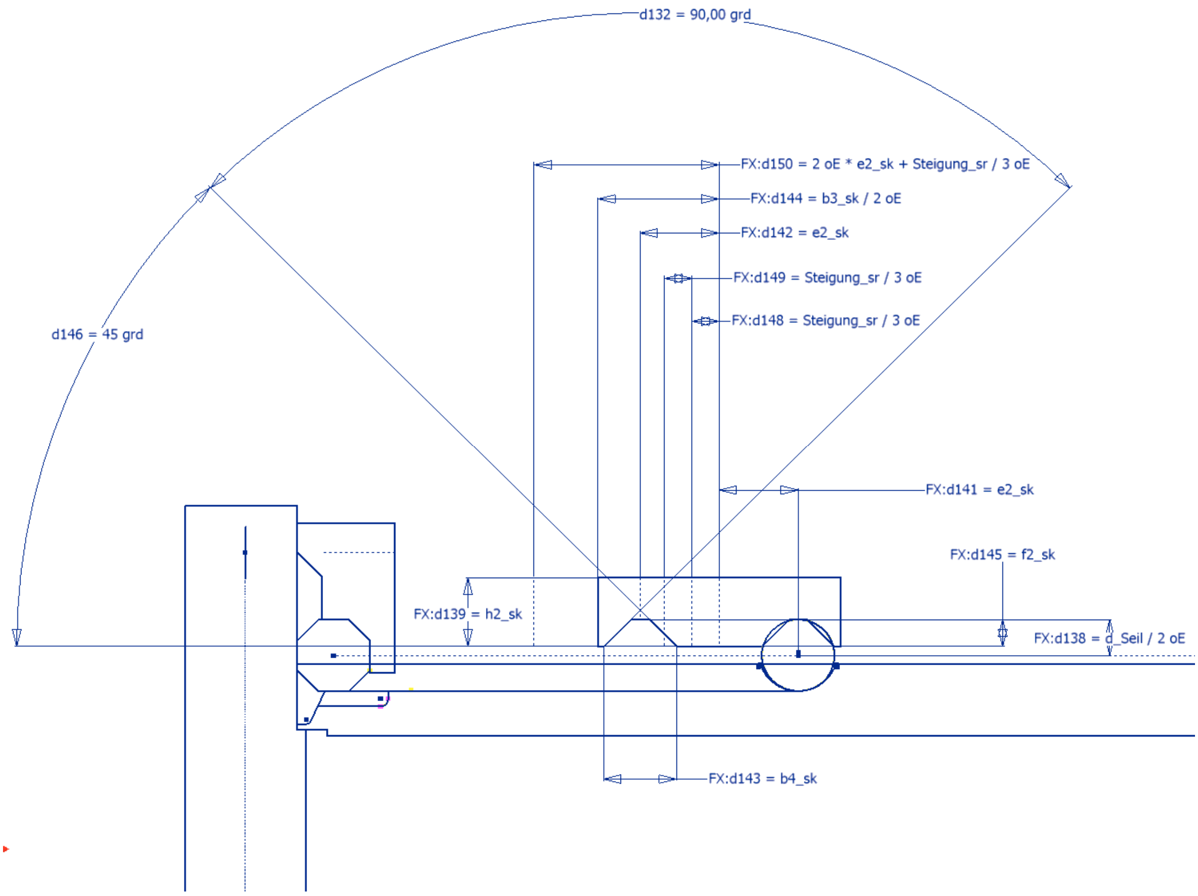
Picture 3-51: Middle – notch

The middle – notch serves two purposes depending on the drum type:

1. Notch for the last winding, where the cable runs onto the drum when it is fully wrapped (drum type: double, outside clamping).
2. Notch for the cable clamps (drum type: double, inside clamping).

It is similar to the notches at the position of thew flanged wheels of the drum.

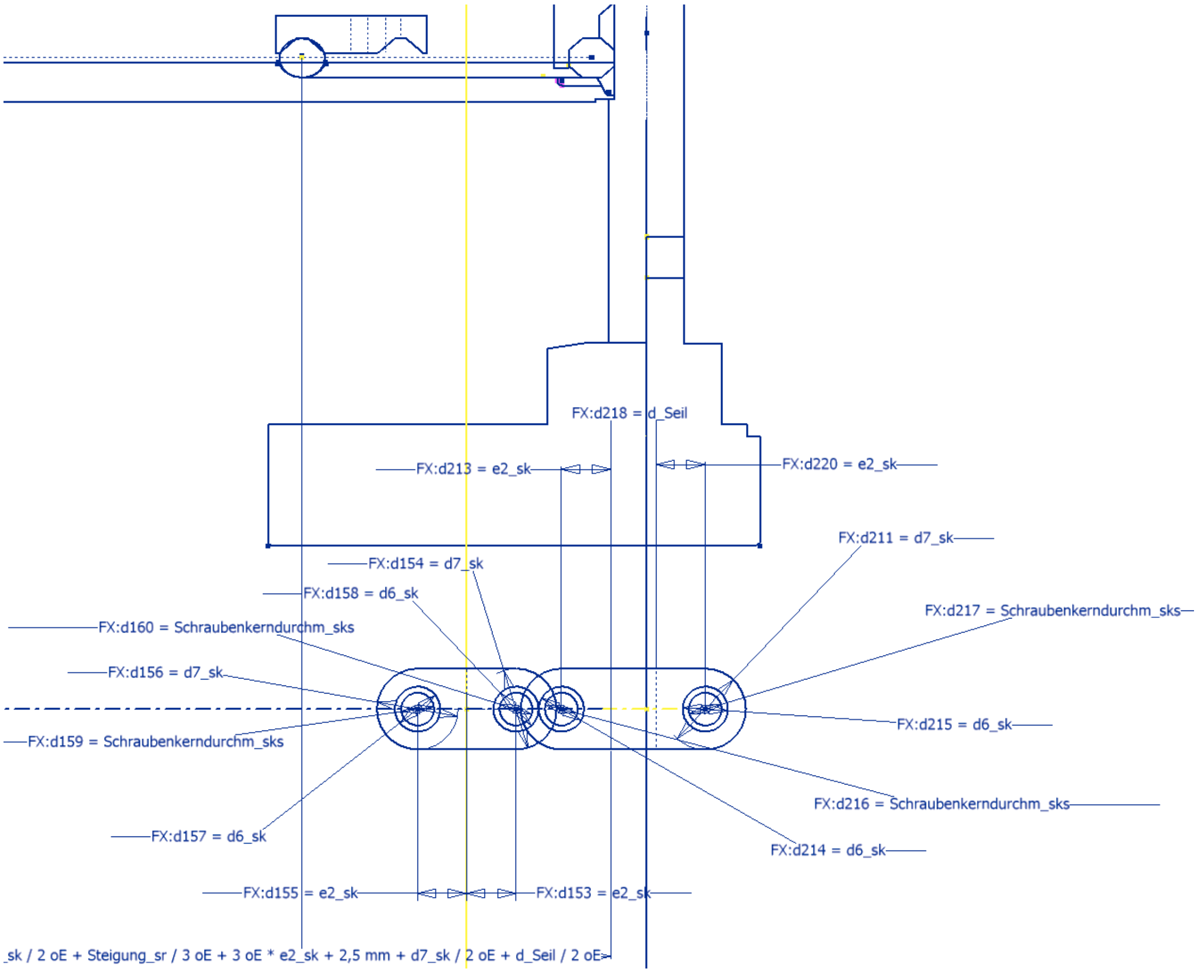
3.3.2.11 On drum cable clamps



Picture 3-52: On drum cable clamps

The design of these cable clamps are completely defined by the standard SEB 666211 (Double clamp) as well as the position of the first clamp. The other two clamps are each shifted 120° and therefore also a third of the height of the cable groove gradient displaced as seen in Picture 3-52 (dimensions FX:d149 and FX:d148). The dimension FX:d150 already defines where the end – clamp is positioned (See Picture 3-34: double drum with outside drum clamping and one parallel cable on page 76).

3.3.2.12 End – clamps



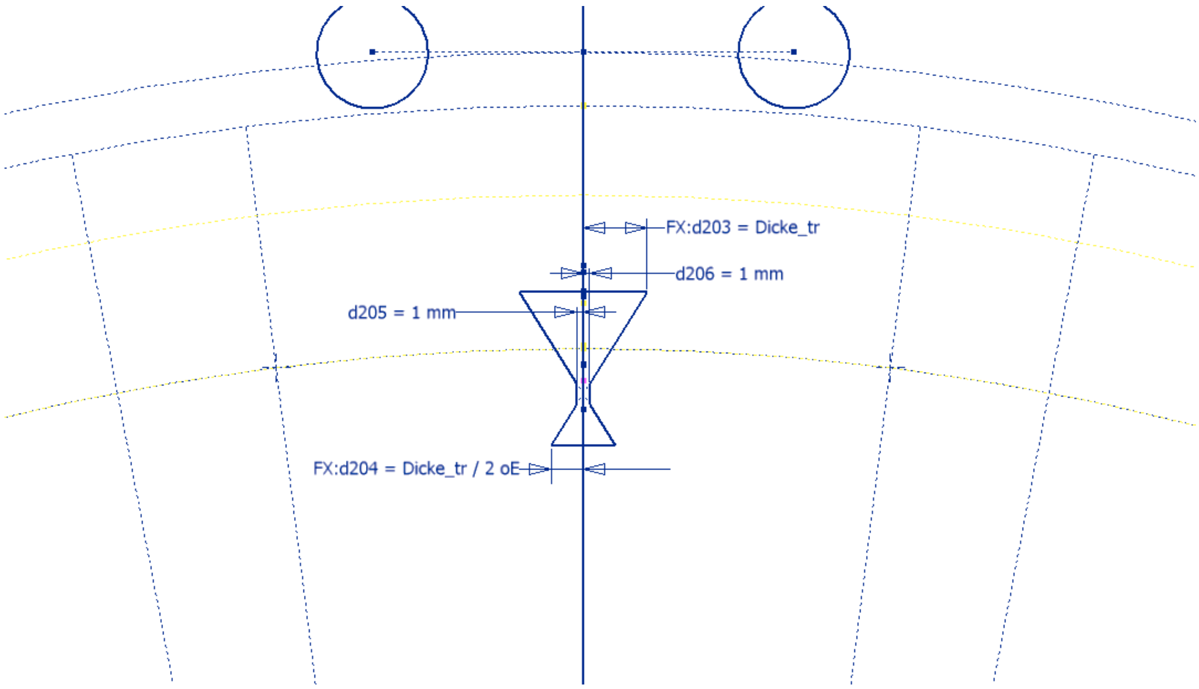
Picture 3-53: End – clamps

The end – clamps serve the purpose of a safe removal of the cable when using double clamps. The problem is that by removing the last clamp, there is still one full winding wrapped on the drum and the possibility exists, that it redounds (Due to the stiffness of the cable) and harms a worker.

In Picture 3-53 the left end – clamp is for a single cable and the right one is if two parallel cables are wrapped around the drum.

The rest of the picture may also seem distorted due to the fact that these clamps are shifted 60° (See Picture 3-33: Totality of all drafts on page 75).

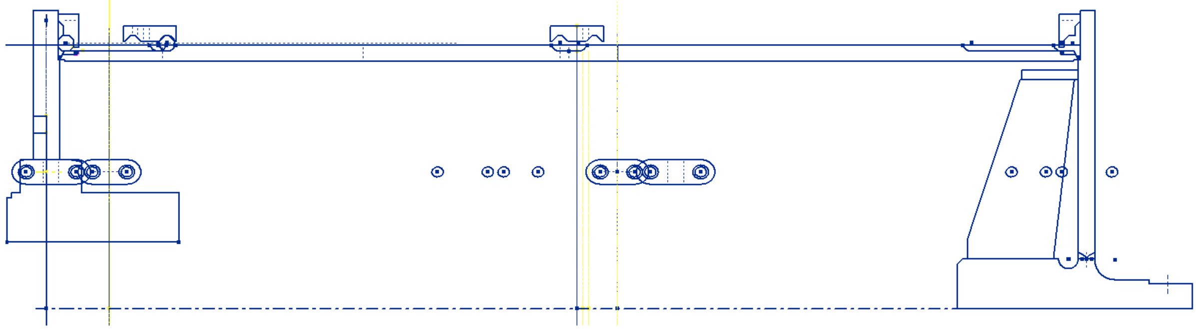
3.3.2.13 Welding seam of the drum



Picture 3-54: Welding seam of the drum

The cut – out of the welding seam of the drum is not really necessary for the design of the drum, because the barrel usually gets manufactured by an external company, but it is applied for describing purposes.

3.3.2.14 Mirroring/Multiplying of certain drafts



Picture 3-55: Mirroring/Multiplying of certain drafts

In order to create all the different drum types, some drafts have to be multiplied or mirrored onto the other side of the drum (e.g., the holes for the cable clamps are mirrored for both inside and outside clamping to the opposite side, also the flanged wheel clamps are copied to the other flanged wheel).

3.4 Assembling of the drum after modeling the parts

Due to the drawing style (All drafts first, description see chapter 3.3.2 on page 75) the assembling of the single parts is not that labor intensive anymore. The parts coupling, coupling – sided flanged wheel, barrel, shaft – sided flanged wheel, ring, ribs, shaft extension and the cable already have their assigned absolute position and therefore just have to be fixed. This is done by a small macro which is already available. By pressing the button shown in Picture 3-56 the macro is activated and then the parts that have to be fixed have to be chosen.

Picture 3-56: Fix to origin

The only parts that have a variable position or amount are the cable clamps and the according screws. They have to be positioned by constraints. Also, in order to create so many different drum types, these parts have to be suppressed or unsuppressed which is done by the rules written in iLogic.

3.5 Making of the 2D construction drawings

Obviously only from 3D drawings no hoisting drum can be manufactured. So after the whole drum is designed, construction drawings have to be made. There is just one big issue that can't be overcome to generate those drawings automatically. The program iLogic is not included in the feature that is necessary to make these 2D drawings and therefore the single dimensions can't be suppressed / unsuppressed. By trying to generate these drawings anyway, every time a different drum type was designed and the 2D drawing was updated, most of the dimensions had errors because the according reference lines were missing due to the fact that they were not valid for the new type. So the only way to create these drawings is manually by hand, but this should not be that time consuming anymore.

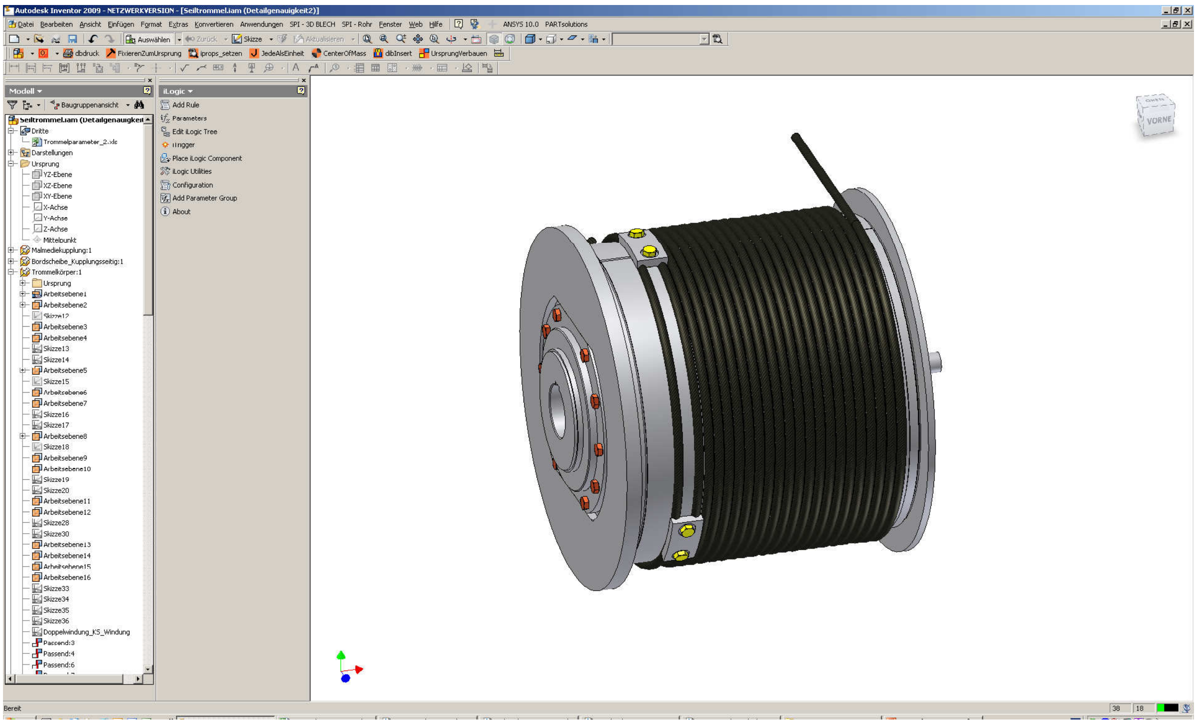
4 Example for creating a new hoisting drum

The specifications for the new desired drum are:

- Double drum
- Clamping of the cable on the drum
- Clamping on the outside of the drum
- One parallel cable
- Lifting weight: 50 tons
- Lifting velocity: 12 m/min
- Lifting height: 12 m
- Mechanism group: 2m
- Classification: H2
- Main working area: 1 – 8 m
- Stress class: E5
- Tension spectrum: 2

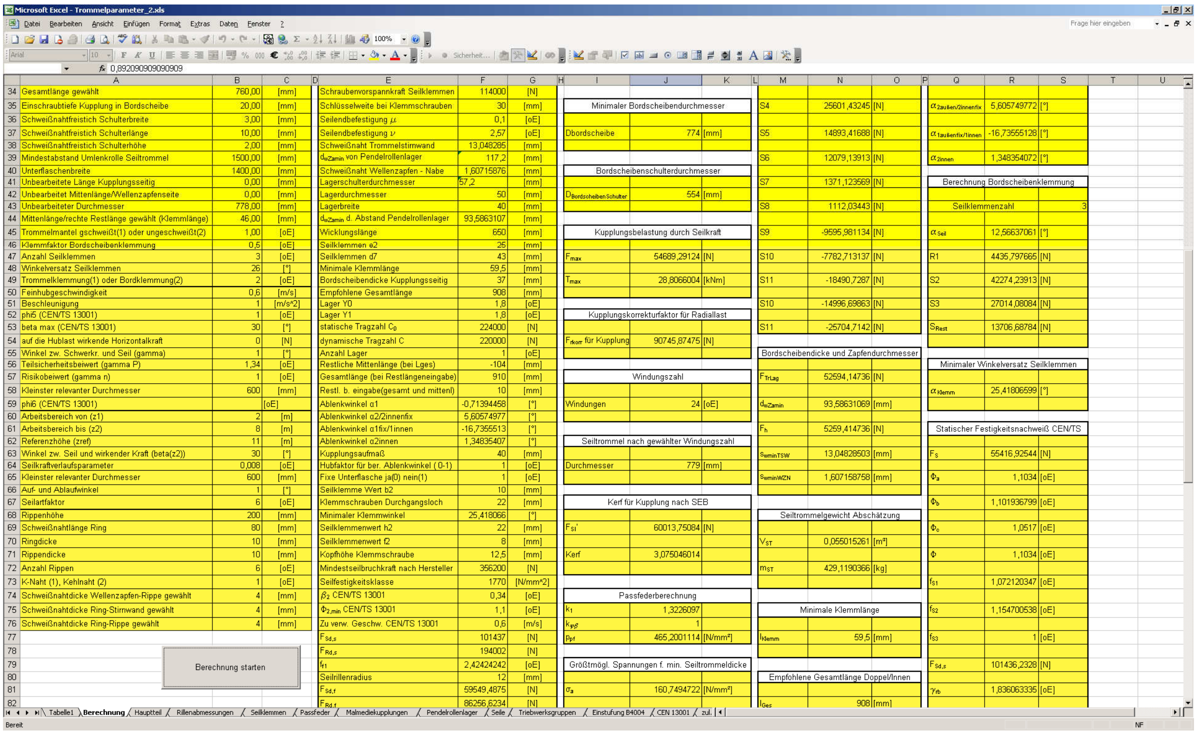
4.1 Open files

The first step to start a new calculation is to open the Inventor file „Seiltrommel.iam" This loads the last valid hoisting drum (Picture 4-1).



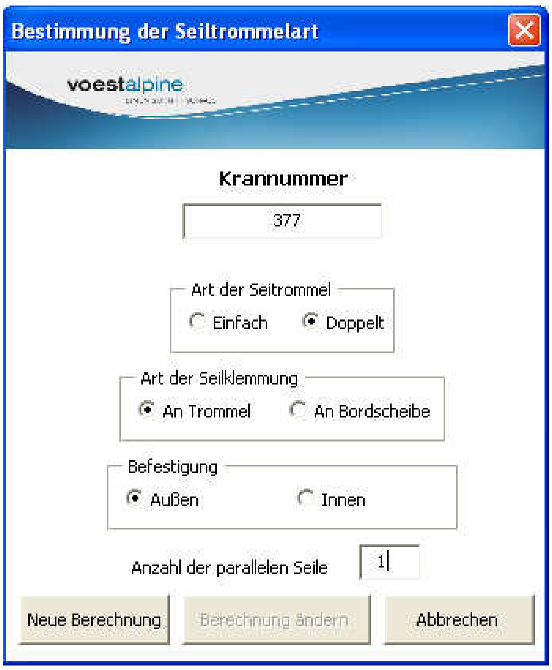
Picture 4-1: Open Inventor file

In the top position of the tab "Modell" on the left side of the program the file "Trommelparameter_2.xls" is displayed which has to be opened to start a new calculation. After doing so the sheet "Berechnung" in the Excel file has to be selected. There the button “Berechnung starten” in the bottom left position of the sheet has to be clicked to run the program (Picture 4-2).



Picture 4-2: Excel sheet "Berechnung"

4.2 Start a new calculation



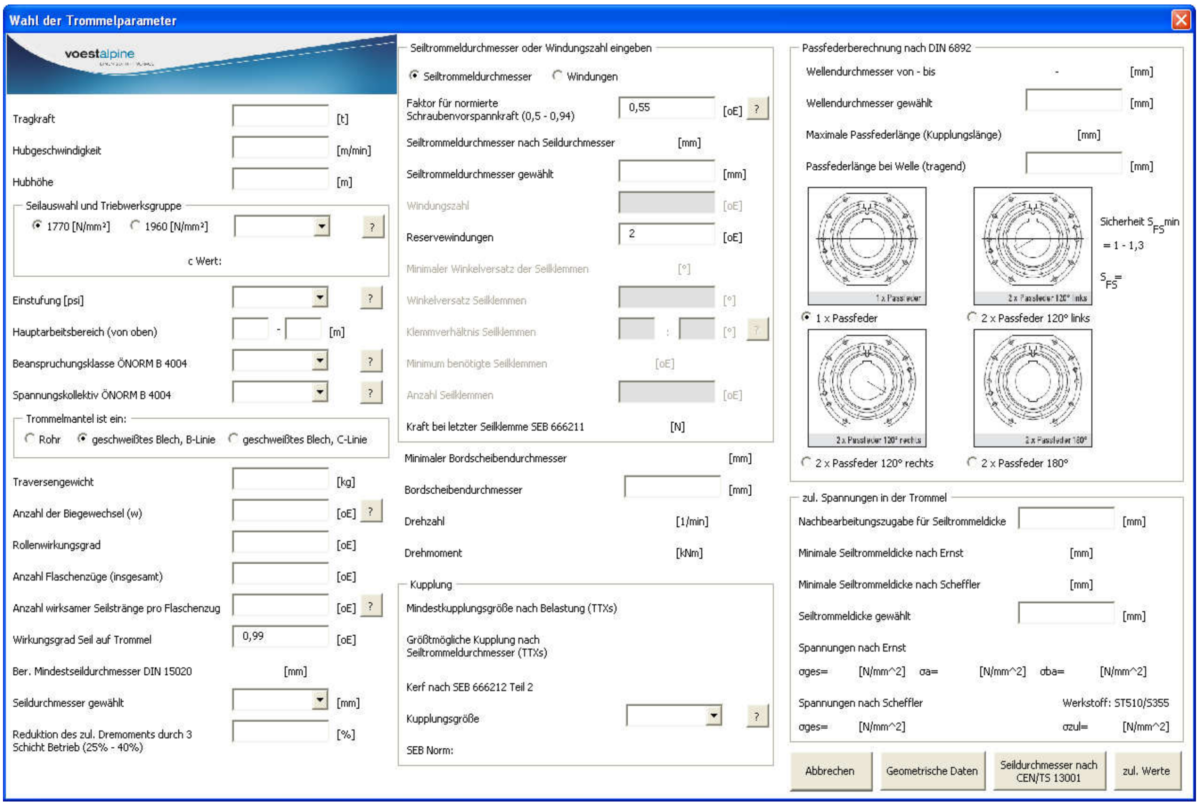
Picture 4-3: “ufmSeiltrommelart”

The input mask to choose the drum type appears. As shown in Picture 4-3 there is no calculation saved, thereby the button “Berechung ändern” is disabled. Now the new specifications of the drum are entered.

They are:

- Crane number: 377 (Exemplarily)
- Double
- On drum clamping
- Outside clamping
- One parallel cable

(This drum type is chosen because it is the most common one) After the settings have been selected, the button “Neue Berechnung” has to be pressed in order to open the next input mask.



Picture 4-4: Overview "ufmParametereingabe"

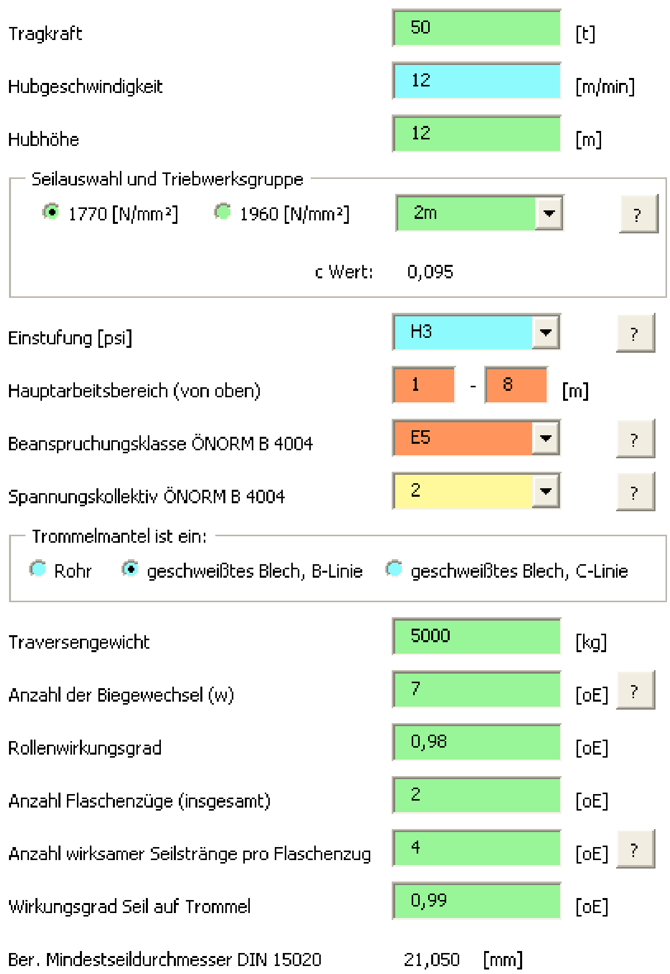
4.3 Input of all calculating parameters

The following chapters go through the input mask in detail. Starting with the input parameters for the cable calculation and defining the valid tensions. The second part is to calculate the minimum coupling size, flanged wheel diameters and the safety force at the cable clamps. The third part is for the calculation of the fitted key and the minimum drum thickness. The order in which the parameters have to be entered is from top to bottom. After a value has been entered, by pressing enter or the tabulator, the cursor jumps into the next input field. The buttons with the question marks (?), on the side of the input fields, are for explanatory purposes. By pushing them, different windows pop up, which explain the parameter that has to be entered (For example, the Picture 8-4 on page 141 is shown for the description of the value “Amount of bends of the cable” when pressing the (?) button right next to it). In order to clarify the connections of the input parameters, in the following pictures the background colors of the input fields have been changed according to their coherence. The parameters are not described anymore, because they are already explained in the before mentioned calculation (2.4.2Calculating fundamentals, on page 17).

Defining the colors of the input fields:

- Green: Calculation of minimum cable diameter (DIN 15020)
- Cyan: Calculation of the ψ factor (ÖNORM B4004-1) for the drum thickness according to Ernst
- Orange: Defining the valid tensions (ÖNORM B4604)
- Yellow: Calculation of the fitted key (G. Niemann)
- Pink: Calculation of the minimum coupling size (Malmedie)
- Blue: Calculation of cable clamps (SEB 666211)
- Red: Enter value for flanged wheel diameter
- Grey: Disabled input field

4.3.1 Cable diameter calculation and defining parameters

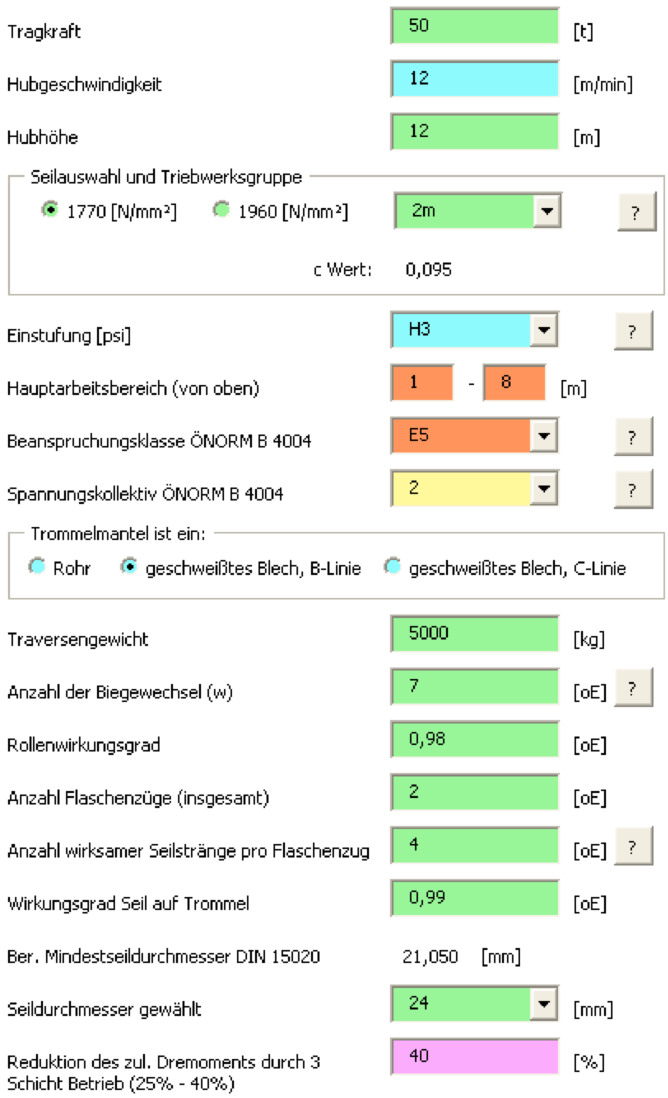


Picture 4-5: First column of "ufmParametereingabe", Part1

Entered parameters (top – bottom):

1. Lifting weight
2. Lifting velocity
3. Lifting height
4. Cable strength / Mechanism group
5. Classification
6. Main working area (Top)
7. Main working area (Bottom)
8. Stress class
9. Tension spectrum
10. Defining if the barrel is welded and which type of seam
11. Weight of the lifting beam
12. Amount of bends of the cable
13. Efficiency factor of the rolls
14. Amount of pulleys
15. Amount of cables per pulley
16. Efficiency factor of the cable to the drum

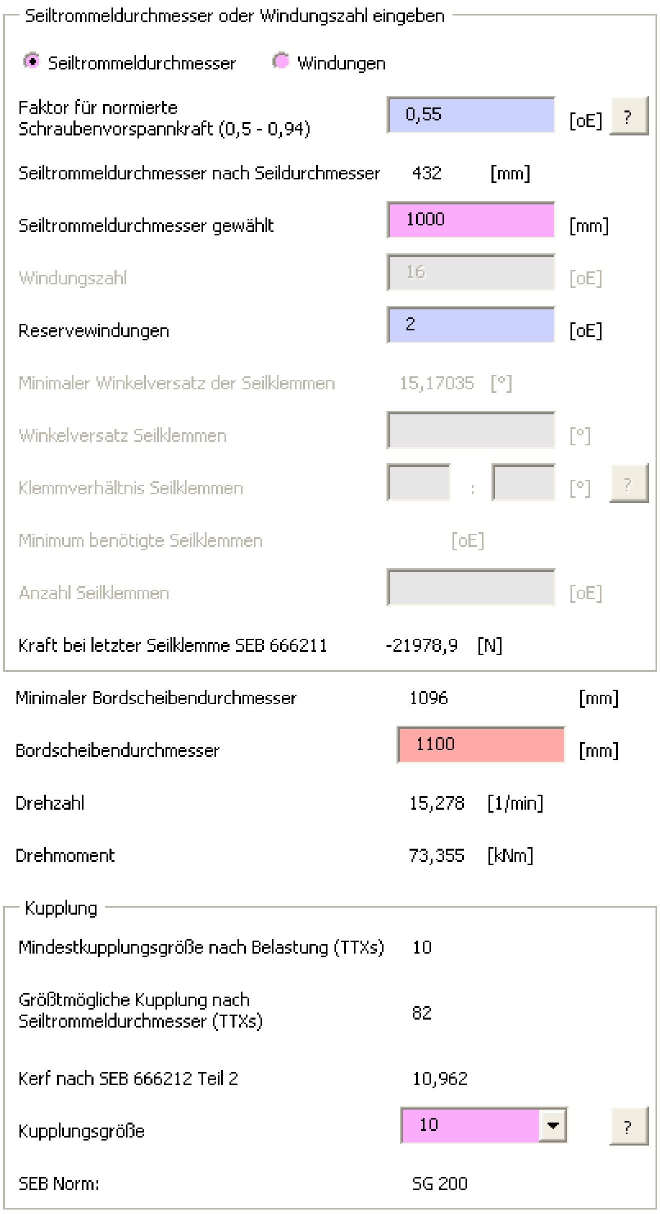
After these values have been entered, the minimum cable diameter is shown and can be chosen in the following combo box.



Picture 4-6: First column of "ufmParametereingabe", Part2

In this case the minimum diameter is 21.05mm (DIN 15020) and a diameter of 24mm is chosen. The next input field is already needed for the calculation of the coupling size (Reduction of the valid torque due to 3 – shift work).

4.3.2 Calculation of coupling size and cable clamps



Picture 4-7: Second column of "ufmParametereingabe"

Entered parameters (Top – bottom):

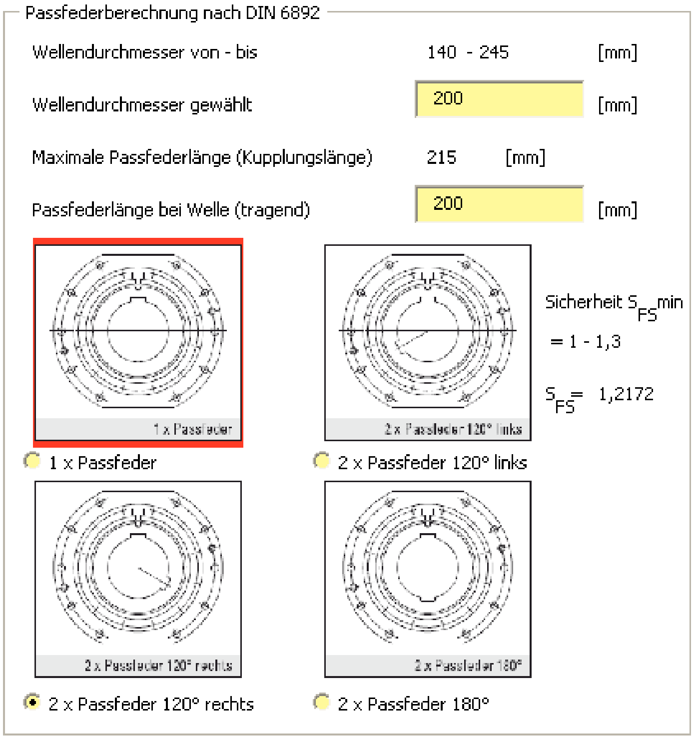
1. Select to enter either the drum diameter or amount of windings
2. Factor for standardized screw preload force
3. Drum diameter
4. Amount of windings (disabled)
5. Amount of reserve windings
6. Angle between the single cable clamps (Flanged wheel clamping)
7. Clamping ratio (Numerator, flanged wheel clamping)
8. Clamping ratio (Denominator, flanged wheel clamping)
9. Amount of cable clamps (Flanged wheel clamping)
10. Flanged wheel outside diameter
11. Coupling size

In the second column, a drum diameter of 1000mm is chosen, although the minimum would be 432mm. This is because the user already has to think about the deflecting angle which is calculated later on (The bigger the diameter of the drum the better for the deflecting angle). By doing so, all valid values are calculated and shown in the following labels of this column (Minimum angle between cable clamps, force at the last cable clamp, minimum flanged wheel diameter, rpm, torque and the minimum / maximum coupling sizes).

When entering the coupling size, the relevant standard (If available) and the diameter range for the shaft to the gearbox is shown in the according labels.

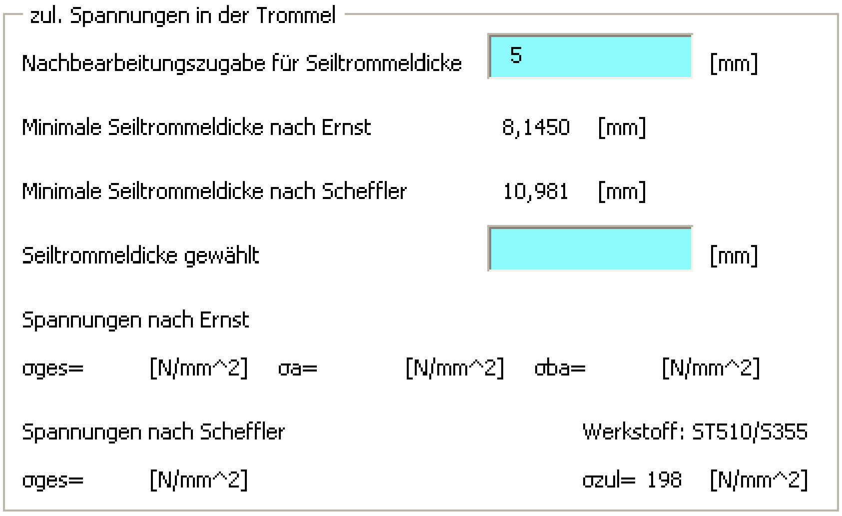
The factor for standardized screw preload force and the amount of reserve windings are already entered but can be changed at any time (This doesn't happen very often).

4.3.3 Calculation of fitted key and minimum drum thickness



Picture 4-8: Third column of "ufmParametereingabe", Part1

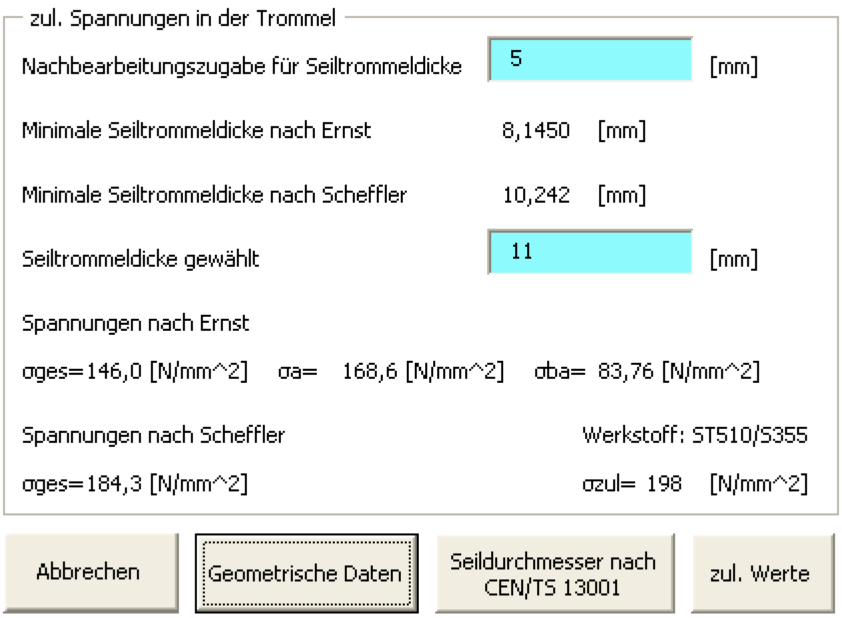
After the dimensions (Gear shaft diameter, key length amount of keys) for the fitted key are entered the safety factor is shown (S_{FS}). As seen in Picture 4-8 the safety for using only one key is too low (Red background color of the picture with just one key) and therefore the amount should be set to two.



Picture 4-9: Third column of "ufmParametereingabe", Part2

By entering the parameter for the post processing allowance, the minimum thickness according to Ernst / Scheffler and the according valid tension (Bottom right of Picture 4-9) are shown.

Due to the calculation method according to Scheffler the value for the minimum drum thickness is recalculated when entering the drum thickness (See 3.2.6 Calculating the minimum drum thickness on page 53).



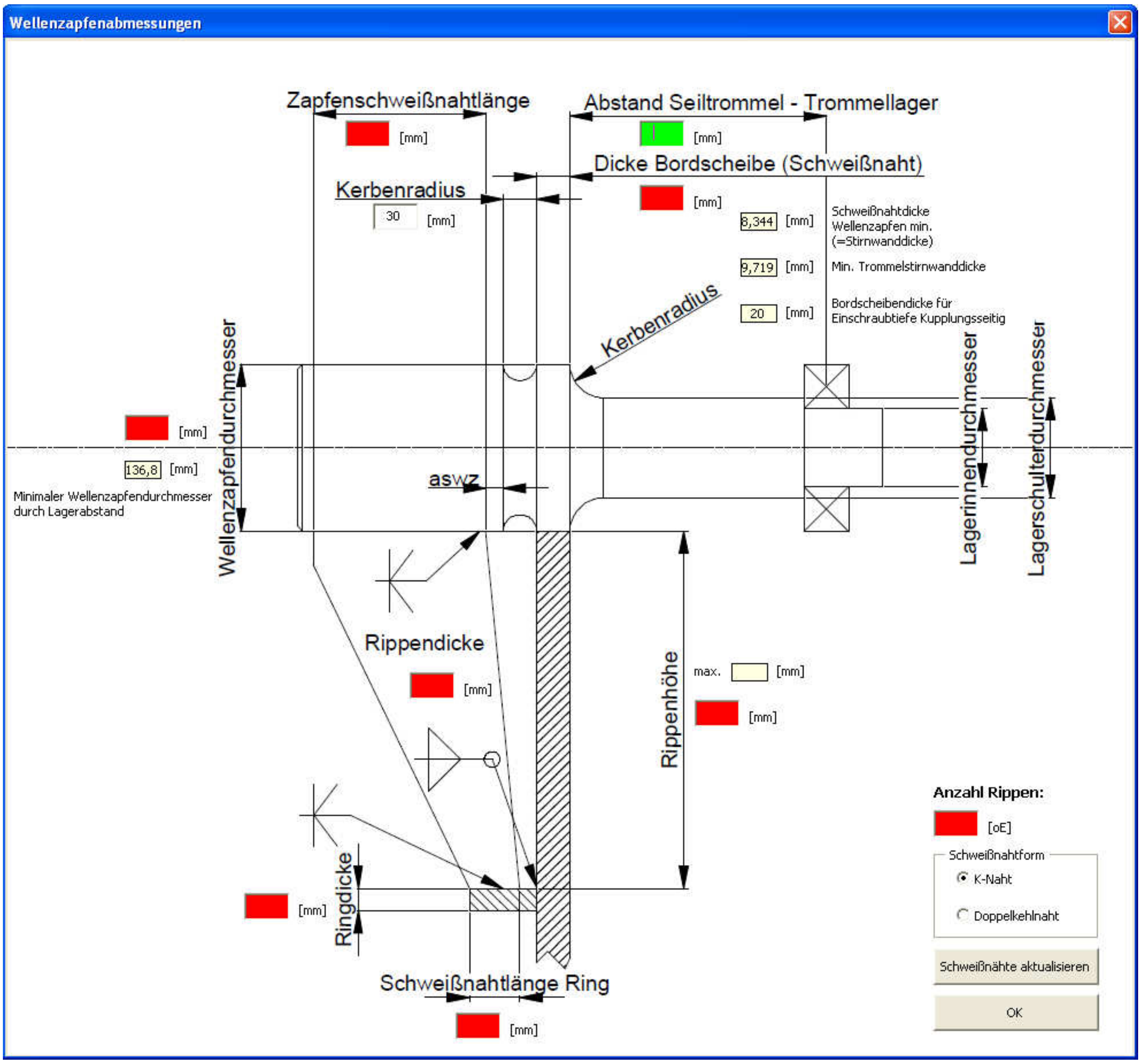
Picture 4-10: Recalculation of the minimum drum thickness according to Scheffler

After the drum thickness has been entered, the actual tensions are dislpayed. This finishes the calculations on this input mask. By pressing the button “Geometrische Daten” the next input mask (ufmWellenzapfen) pops up to enter the geometrical parameters.

4.4 Input of the geometrical parameters

The order of entering the parameters in the next input masks also follows a strict order. The difference to the last input mask is that the input fields are not listed from top to bottom anymore but are scattered all over the input mask. Due to this the active input field is highlighted green, so that the user can find the position of the cursor more easily.

4.4.1 Entering the parameters for the shaft extension



Picture 4-11: "ufmWellenzapfen" empty

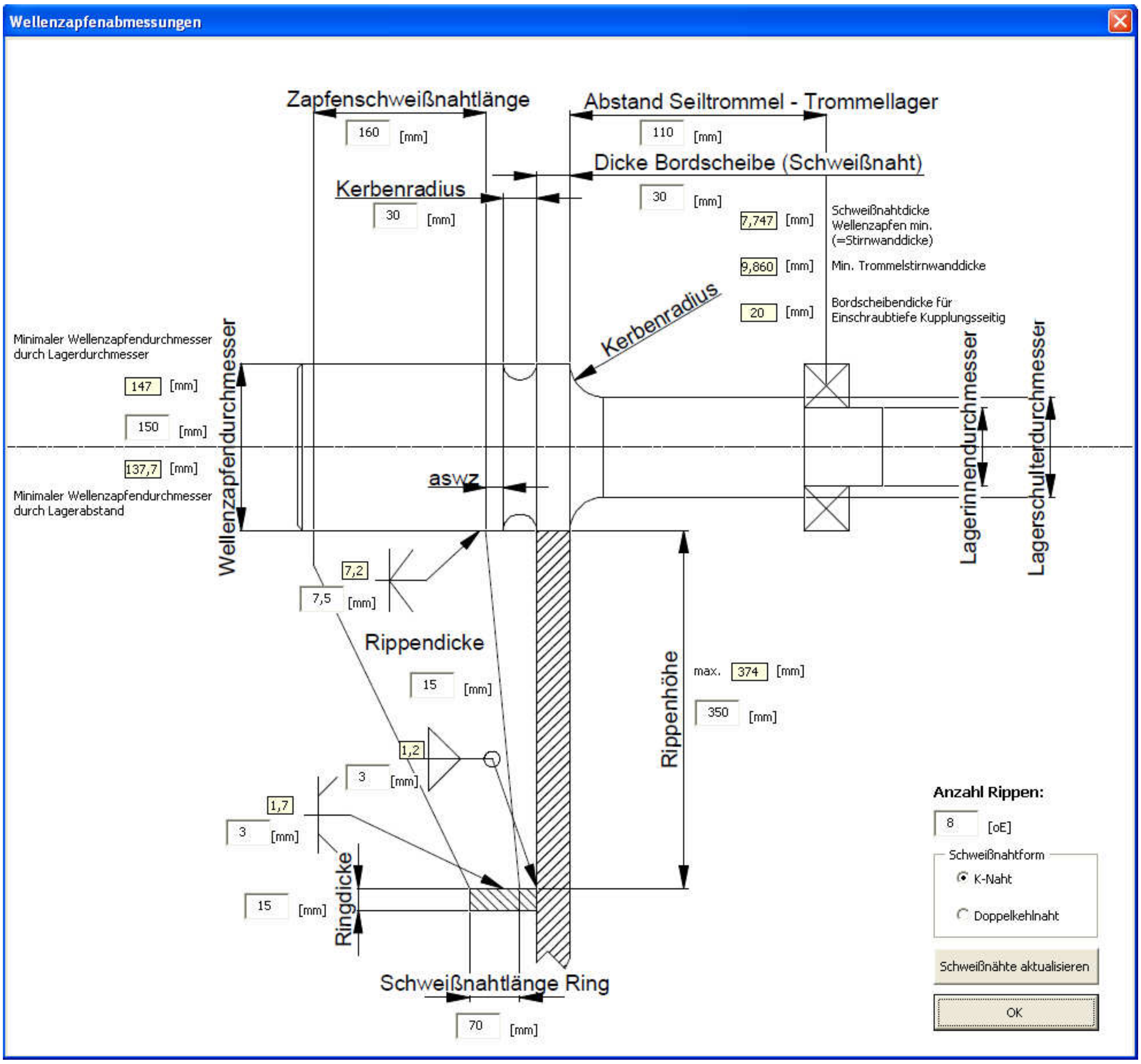
The fields that are highlighted red, have either no value entered or the value is invalid.

The parameters in this mask should be entered in the following way:

1. Distance between the flanged wheeland the middle of the bearing seat
2. Flanged wheel thickness (shaft – sided)

3. Length of the welding seam (shaft – ribs)
4. Shaft diameter
5. Thickness of the ribs
6. Thickness of the ring
7. Length of the welding seam(Ring – Ribs)
8. Height of the ribs
9. Amount of ribs

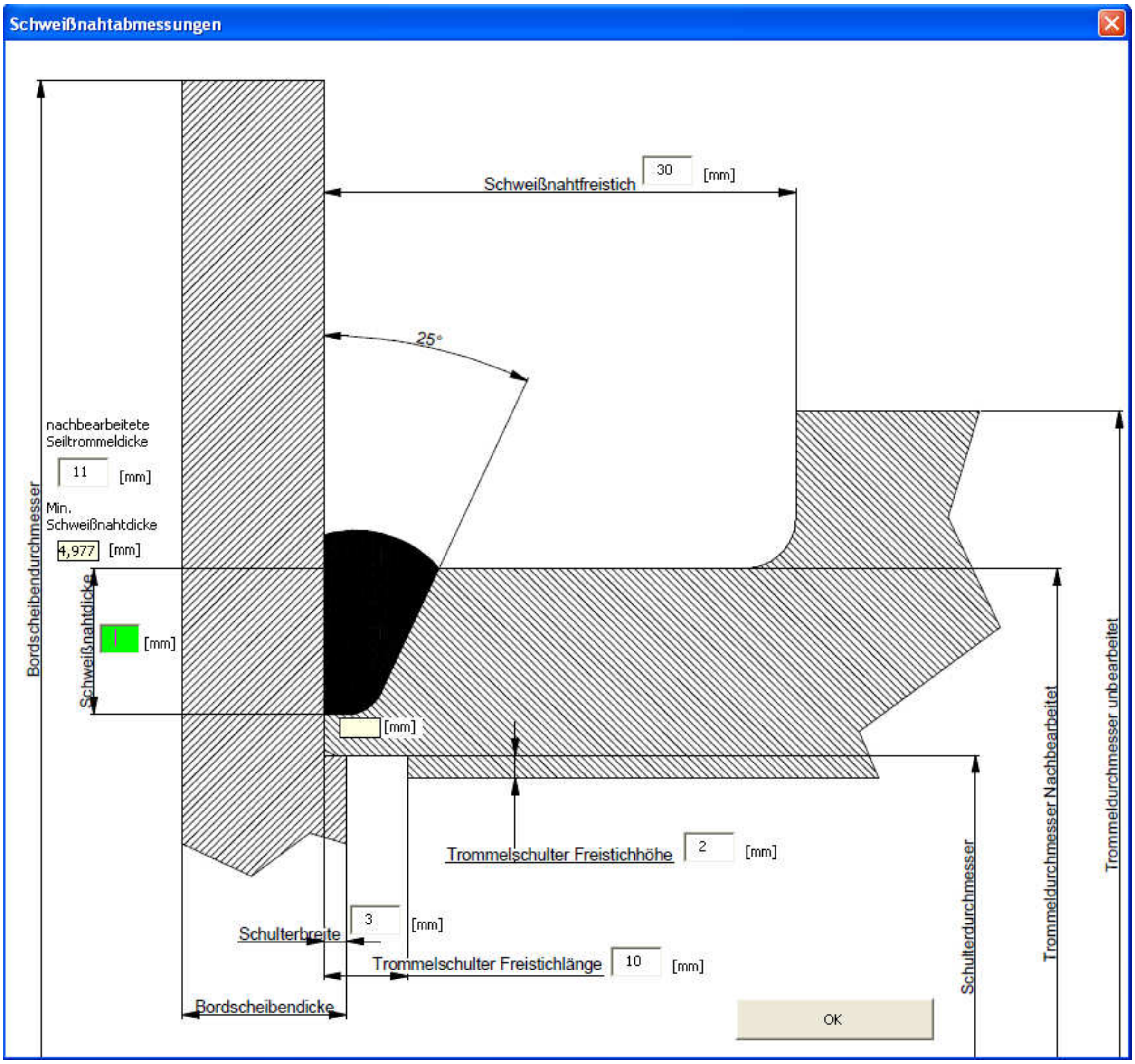
After these values have been entered, the user has to press the button “Schweißnähte aktualisieren” (Update welding seams) in order to calculate the minimum thickness of the welding seams. By doing so, the input fields for these seams are made visible.



Picture 4-12: "ufmWellenzapfen" with all parameters entered

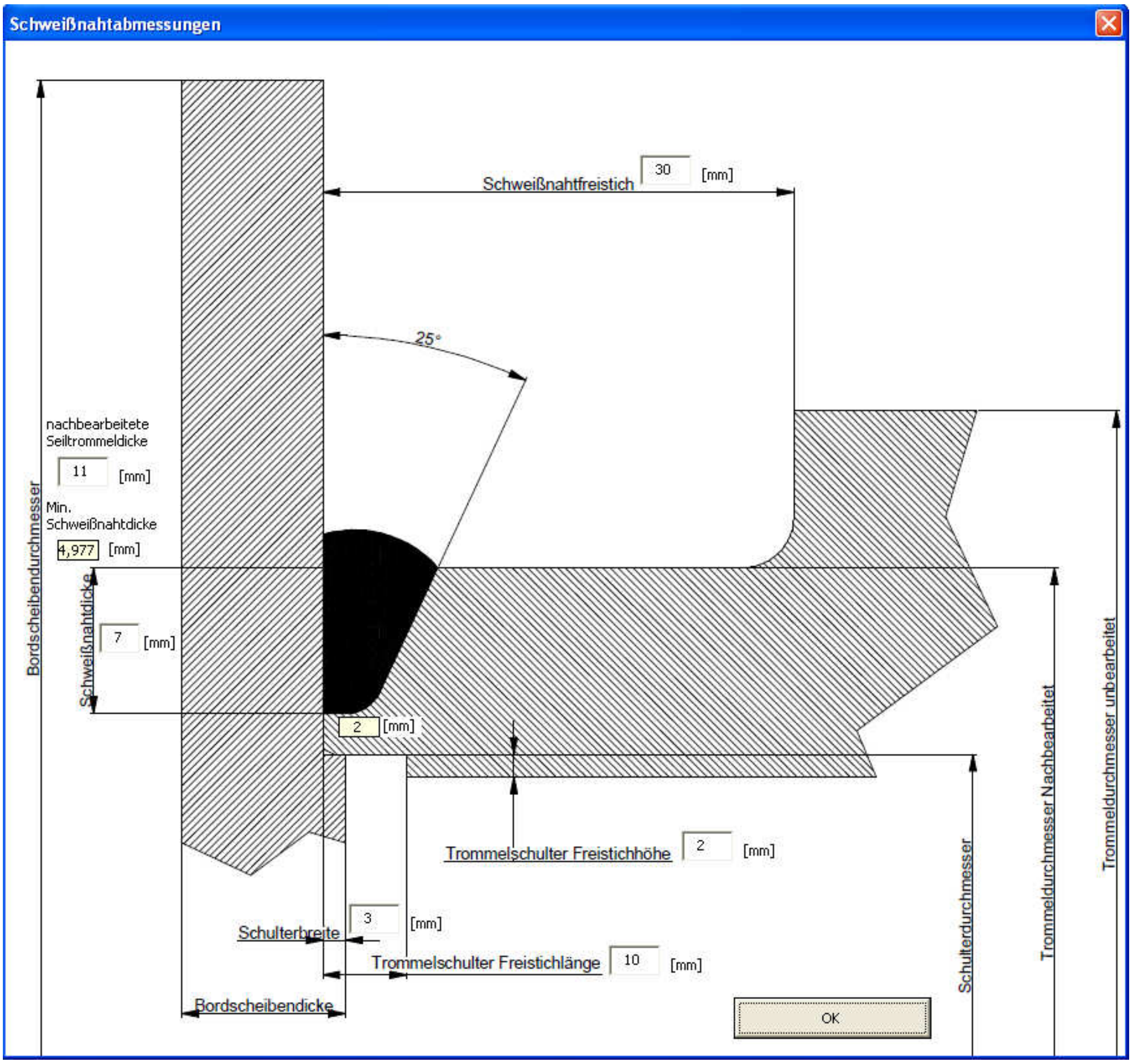
As seen in Picture 4-12, the types of welding seams have changed according to the input parameters. If the entered welding seam thickness is half the thickness of the ribs, the welding type is a K – seam, otherwise it would be a DHY – seam. The third option, which has to be selected explicitly (Bottom right of Picture 4-12), would be a throat seam.

4.4.2 Entering the parameters for the welding seam preparation



Picture 4-13: "ufmSchweißnahtfreistich"

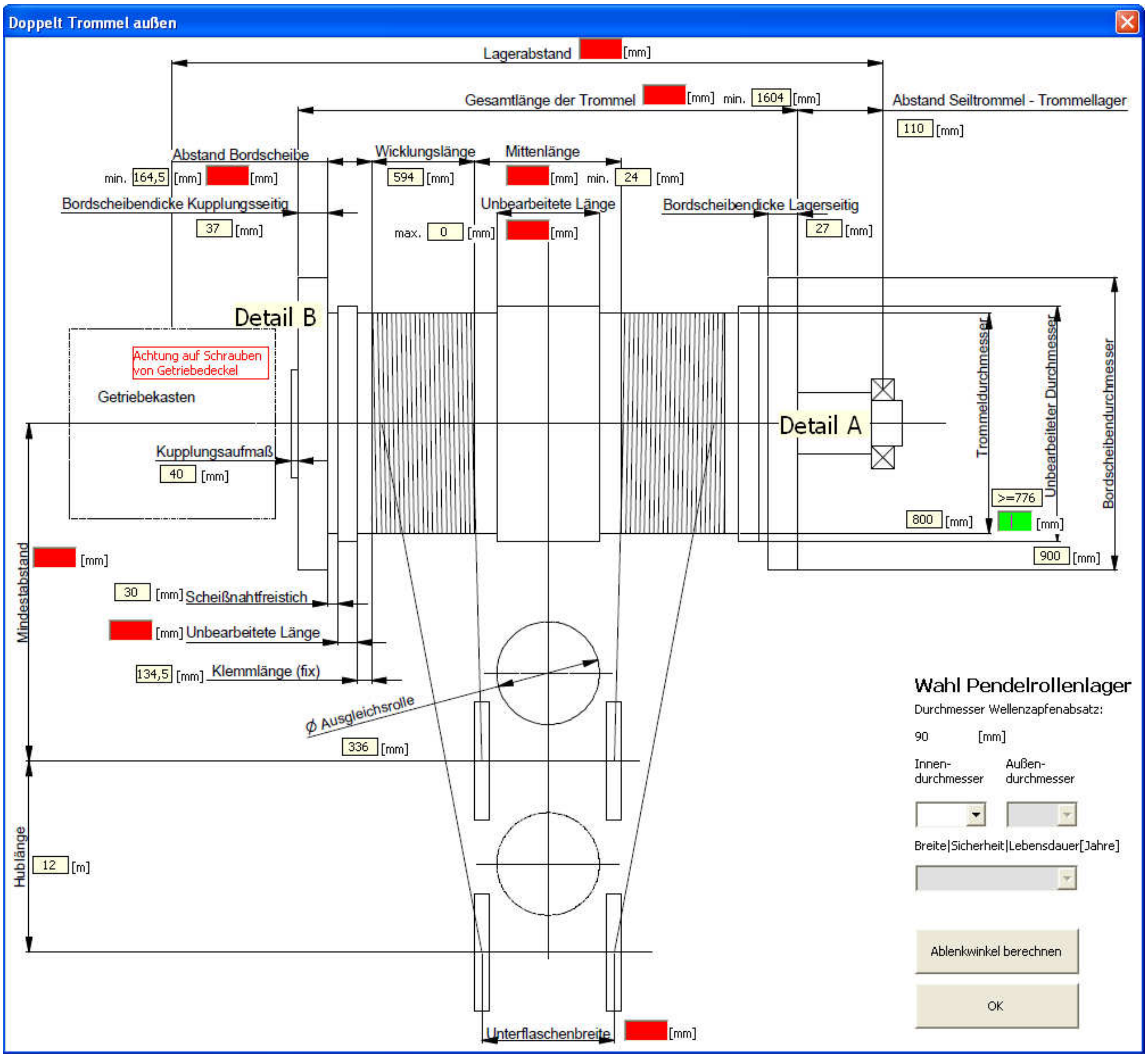
In this input mask all parameters but one are already entered. This is because these values just change very seldom. The only missing value is the height of the welding seam. It should always be about 4mm smaller than the post processed thickness of the drum but never smaller than the calculated minimum value (Shown in the light yellow label next to it, Picture 4-14).



Picture 4-14: "ufmSchweißnahtfreistich" with all parameters entered

If the thickness is too low to meet these conditions, it can always be changed in the input field above.

4.4.3 Entering of main length parameters and bearing size



Picture 4-15: "ufmAblenkwinkel" empty

As can be seen in Picture 4-15 for all length parameters that relate to the dimension of the drum itself, a minimum value is shown next to the input field in light yellow labels.

Order in which to enter the parameters:

1. Unworked diameter
2. Distance windings – flanged wheel
3. Overall length
4. Distance of the bearing to the middle of the gearbox (Or similar)
5. Distance of the drum to the bottom part of the pulley
6. Width of the bottom part of the pulley
7. Inside bearing diameter
8. Outside bearing diameter
9. Bearing width

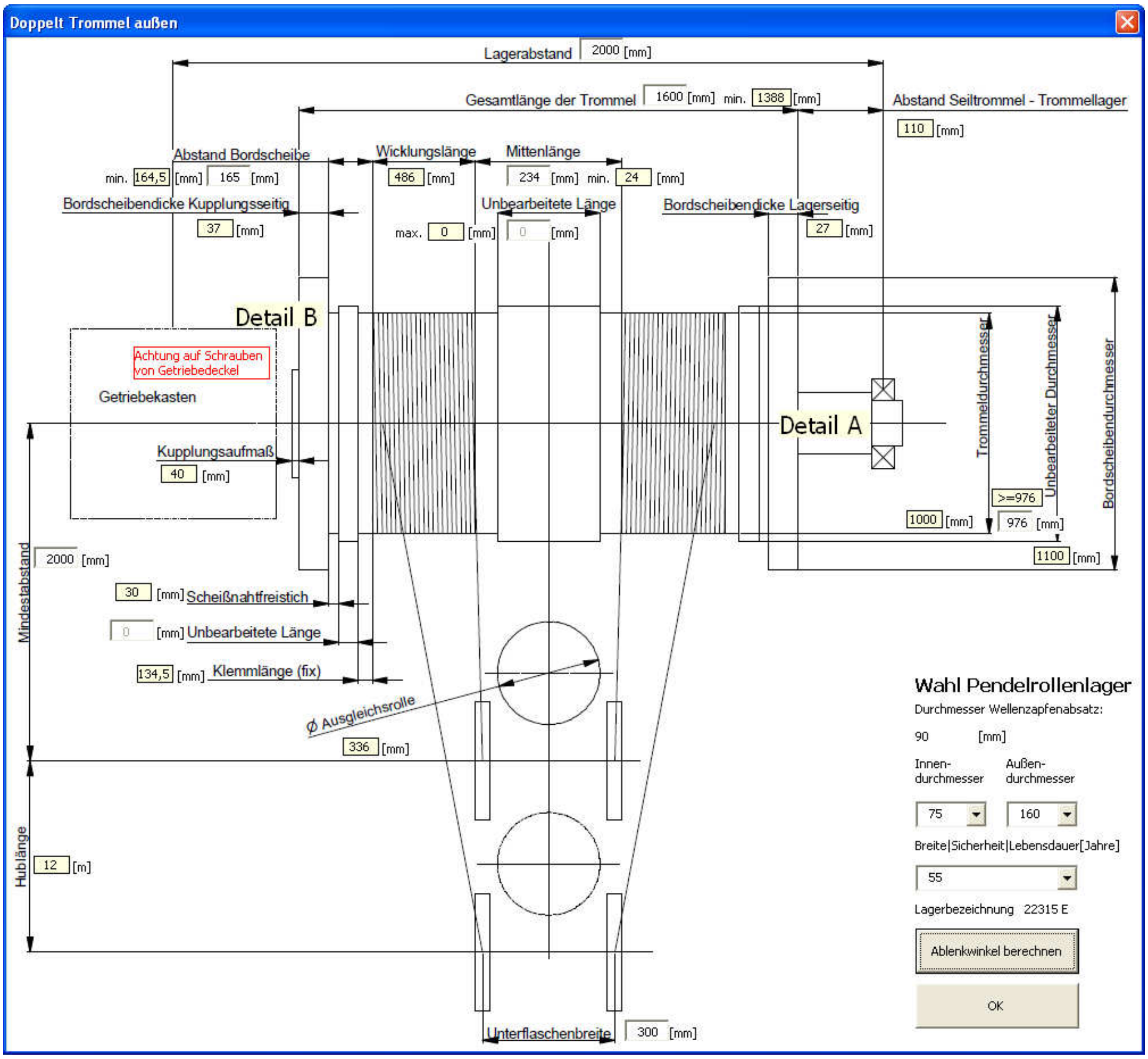
In the above list of parameters not all input fields have been mentioned. For example, if the first value that is entered (Unworked diameter, green in Picture

4-15) is bigger than the suggested one, then the next value to enter would not be the distance of the windings to the flanged wheel, but the length of these unworked areas.

Also the distance of the windings to each other is not mentioned, this is because the other two lengths were entered (distance flanged wheel – windings and overall length) and therefore the third length was calculated and entered automatically (See Picture 3-24 on page 65).

The last step in this input mask is to enter the bearing size. To get a first hint at wich size of inside diameter for the bearing to start with entering, the diameter of the shoulder, where the bearing is fixed, is shown. A good first estimation would be to choose an inside diameter that is approximately 15mm lower than the shoulder diameter (The shoulder diameter is 30mm smaller than the shaft diameter that has been entered previously). If however the necessary shoulder diameter, which is depending on the chosen bearing, is too low the label "Detail A" is highlighted red to warn the user that one has to change the bearing size or the shaft diameter. This is done by reopening the input mask "ufmWellenzapfen" by clicking on the according label (Detail A).

The other input mask can of course also be reopened by clicking on the label "Detail B".

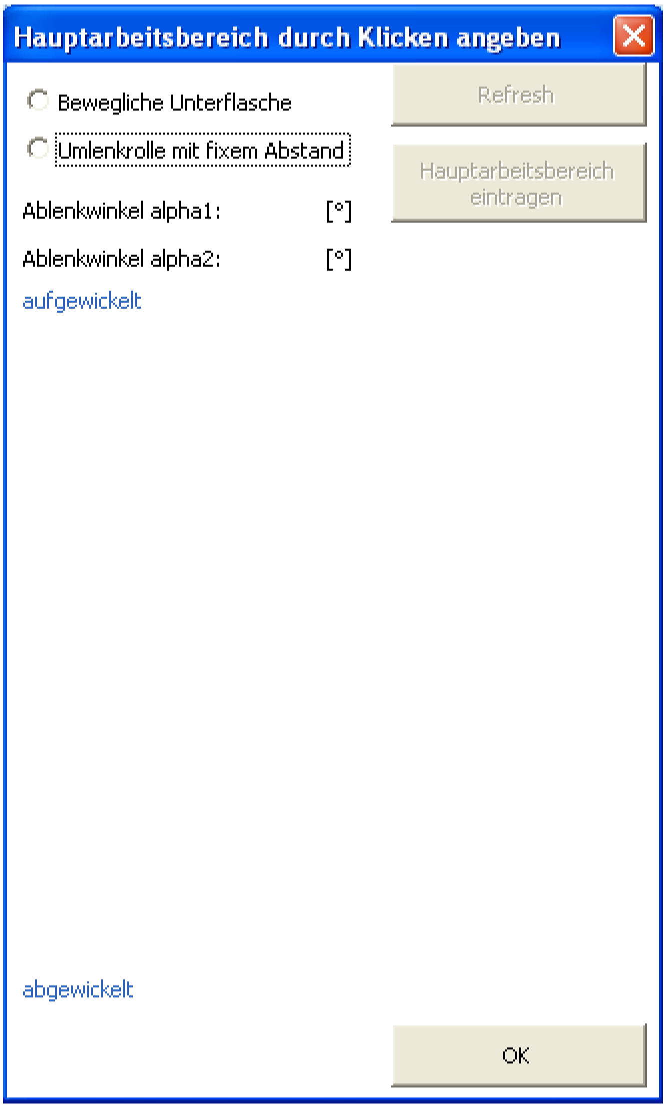


Picture 4-16: "ufmAblenkwinkel" with all parameters entered

On the bottom right of the input mask, the safety and the lifetime of the bearing is shown in the dropdown box when choosing the width of the bearing.

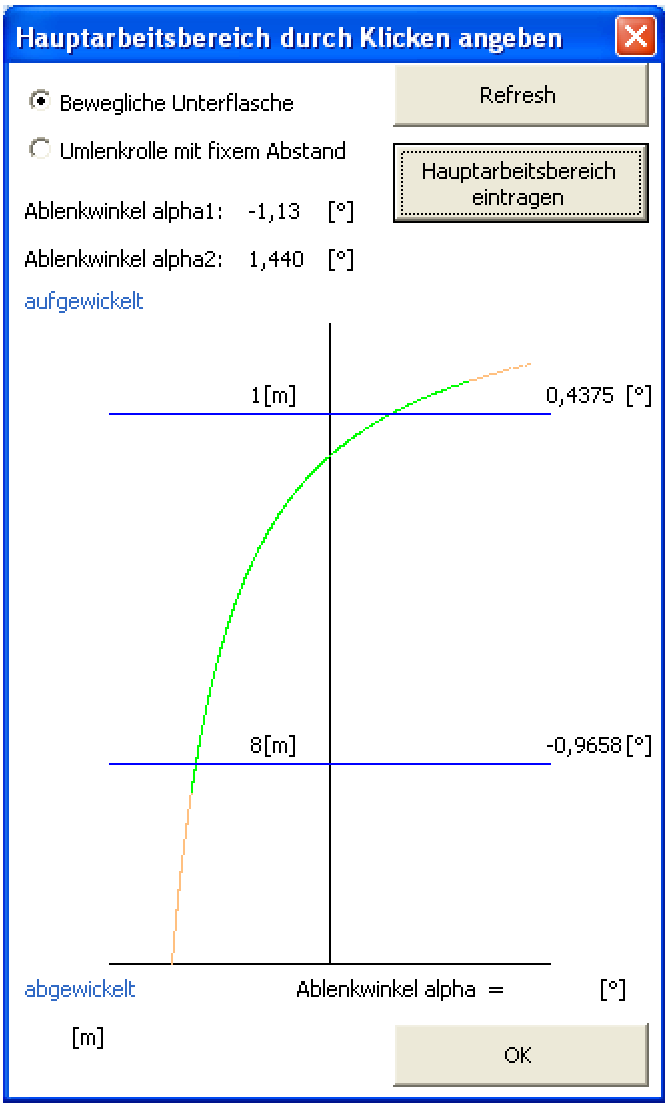
After all the values have been entered, the next step is to draw the deflecting angle by pressing the button “Ablenkwinkel berechnen” which opens the next input mask “ufmHauptarbeitsbereich”.

4.4.4 Drawing the deflecting angle



Picture 4-17: "ufmHauptarbeitsbereich" empty

As described in 3.2.12Calculating the deflecting angle on page 69 the user now has to choose the type of pulley by pressing the according option button. The label with the content “Bewegliche Unterflasche” means that the pulley is moving. The other option button (“Umlenkrolle mit fixem Abstand”) means that there is just a deflection sheave and not a pulley for lifting the load.



Picture 4-18: "ufmHauptarbeitsbereich" with drawn deflecting angle

In Picture 4-18 the blue lines for the main working area are already shown. This was done by pressing the button "Hauptarbeitsbereich eintragen" which is only enabled if these values have been entered before in the input mask "ufmParametereingabe". Otherwise it can be entered afterwards or changed, by clicking into the mask at the position where the main working area is (first click → top, second click → bottom).

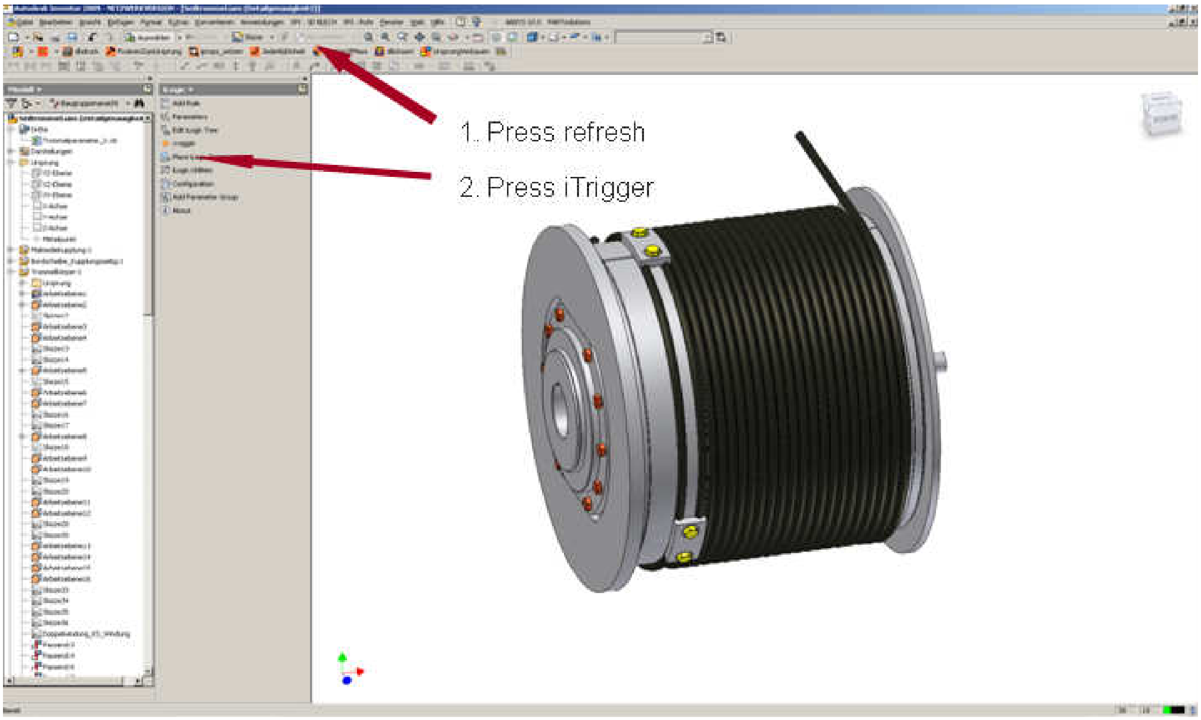
If the deflecting angle is now to the user's satisfaction the calculation is finished, otherwise one still has the possibility to change all entered parameters.

By pressing the button "OK" the input mask is closed and the last mask (ufmAblenkwinkel) is shown. Here the user also has to push the "OK" button to close the window so that the mask "ufmParametereingabe" reappears (If now no window appears, which informs you that any of the entered parameters are incorrect, the hosting drum can be modeled properly). In this mask the button "Abbrechen" has changed to "OK" and thereby it is verified that the calculation is finished.

4.4.5 Next steps

In order to make the previous changes go into effect, the Excel file has to be saved. Also if the user wants to print out the calculation for documentation purposes, he / she is able to do so now (Excel sheet “Hauptteil”). But before, if the cable calculation according to CEN/TS 13001 – 3 has not been performed, the according parts of the Excel sheet have to be suppressed (Otherwise unnecessary pages are printed out).

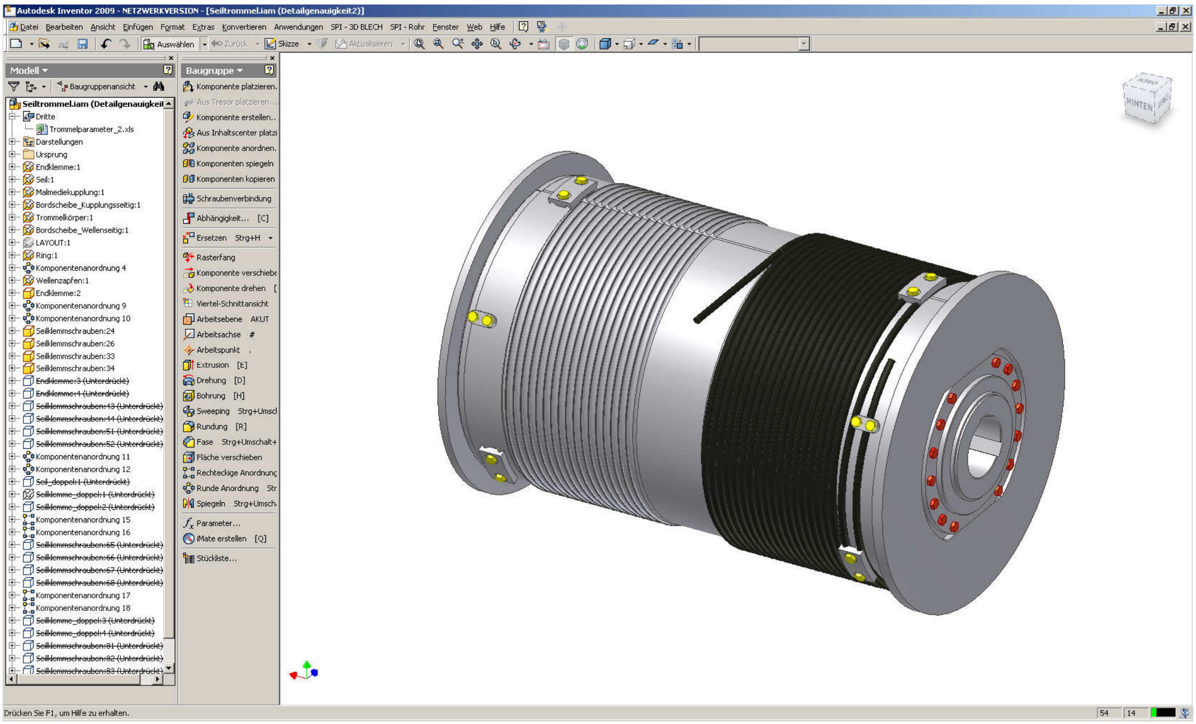
4.5 Updating the Inventor file



Picture 4-19: Updating the Inventor file

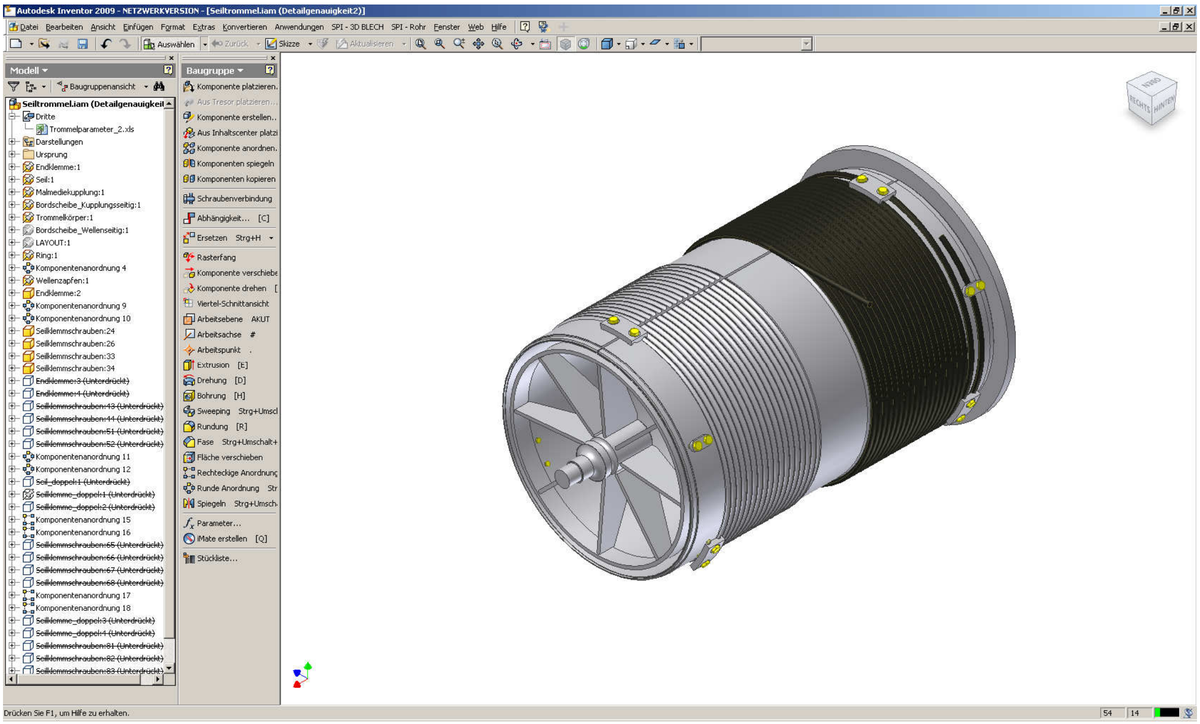
To update the Inventor file, two buttons (“Aktualisieren” and “iTrigger”) have to be pressed one after another. The first one changes all geometrical values according to the Excel file. The second one updates all rules that are written in iLogic. Sometimes it can occur that not every rule is performed successfully, so that the button “Aktualisieren” has to be pressed a second time.

Normally it would be enough to just press “Aktualisieren” to update everything, but test runs showed that the process of updating is sometimes too intensive for the available computer capacity and therefore has to be done in two steps. This specially occurs with a drum type for two parallel cables (Updating time up to 15 minutes!).



Picture 4-20: Updated hoisting drum, view1

In Picture 4-21 the shaft – sided flanged wheel is made invisible in order to have a look inside the drum.



Picture 4-21: Updated hoisting drum, view2

After the updating is finished, the 2D drawings can be generated out of the assembly file.

4.6 Checking the results / Quality assurance of the program (Test runs)

During the programming, calculating and drawing of this work, everything was cross checked several times. Every time a new routine was added, the program was executed at least once to check for any eventual mistakes. Also when adding a new calculation, the results were compared with given calculations of existing hoisting drums (During this testing the program detected some errors in the existing calculations, which were corrected immediately). Also the input values where limited to numbers, commas and arithmetic operators (So that nobody could accidentally enter a letter or any other unwanted character).

The calculation has been checked by Mr. Martin Schuhbauer to guarantee the safety of the project also Mr. Andreas Platzer and Mr. Thomas Nairz have been instructed in the program code to be able to make eventual changes, all of them are highly experienced design engineers.

4.6.1 Calculating fundamentals (Excel)

4.6.1.1 Welding seam (Ring – flanged wheel)

3.16 Schweißnahtberechnungen

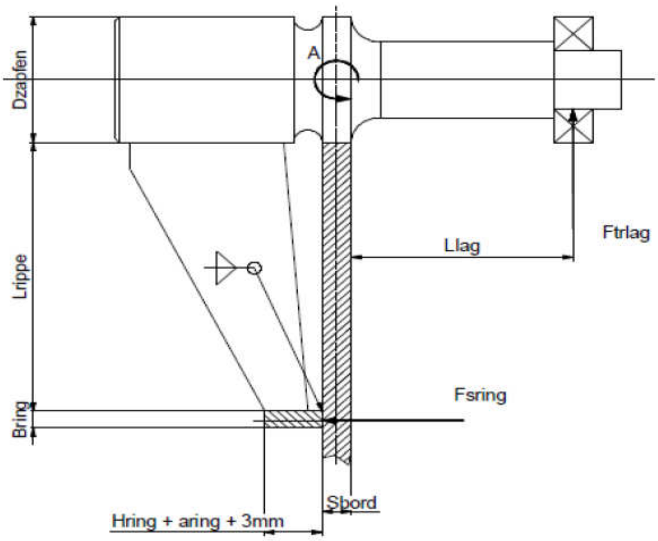
3.16.1 Ringnaht

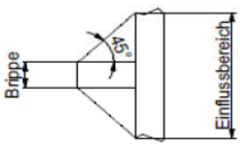
D_{zapfen} =	150,00	[mm]	Z_{rippen} =	8	[oE]
L_{rippe}	350	[mm]	B_{rippe} =	15	[mm]
B_{ring} =	15	[mm]	L_{lag} =	110,00	[mm]
H_{ring} =	70	[mm]	s_{bord} =	30,00	[mm]

F_{trlag} = F_{max} = 78865,8 [N]

σ_{zul} = 19,1 [N/mm²]

Beanspruchungskl. E7, F-Linie, wechselnd





Einflussbereich:

L_{SNRing} = $(2 \times H_{Ring} + B_{rippe})$

L_{SNRing} = 155 [mm]

$\Sigma M_A = 0$

$$F_{SRing} = F_{trlag} \times \frac{L_{lag} + s_{bord}/2}{(D_{zapfen}/2 + L_{rippe} + B_{ring}/2) \times z_{rippen}/2} + \frac{F_h \times 2}{z_{rippen}}$$

F_{SRing} = 7670,0379 [N]

$$\sigma_{zul} = \frac{F_{SRing}}{A_{SNRing}}$$

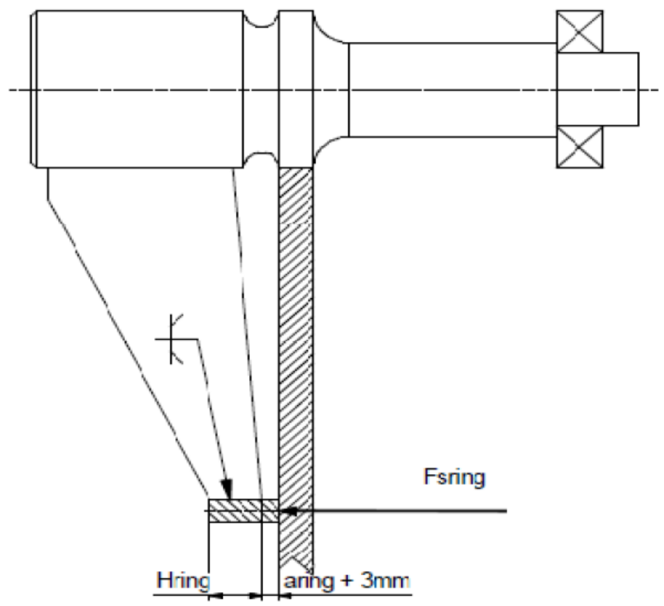
$$a_{Ringmin} = \frac{F_{SRing}}{2 \times \sigma_{zul} \times L_{relevant}}$$

$a_{Ringmin}$ = 1,30 [mm] < $a_{Ringgew}$ = 3 [mm]

Picture 4-22: Excel calculation of the welding seam (Ring – flanged wheel)

4.6.1.2 Welding seam (Ring – ribs)

3.16.2 Ring - Rippen



F_{SRing} = 7670,0 [N]

H_{ring} = 70 [mm]

σ_{zul} = 31,8 [N/mm²]

Dpl.-HY-Kehlnaht, E52-Linie *Beanspruchungskl. E7, wechselnd*

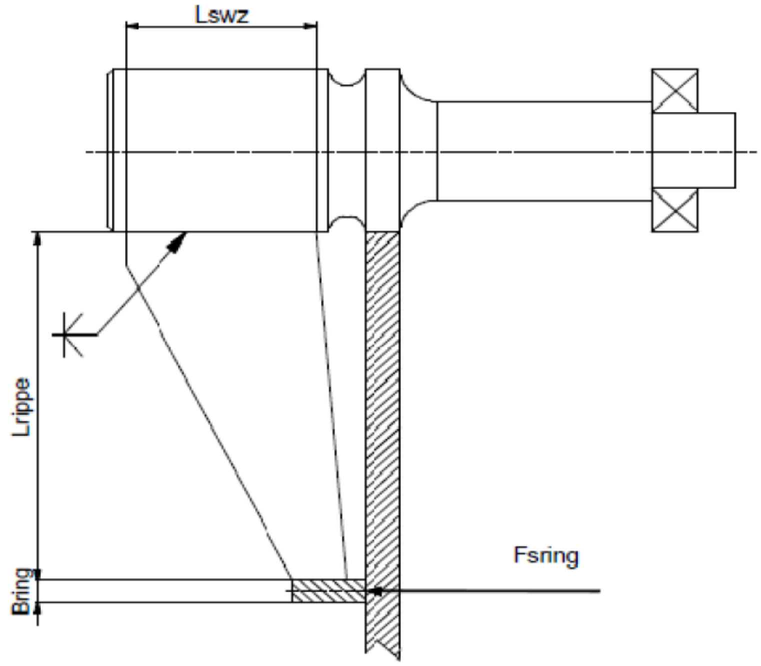
$$a_{RiRip} = \frac{F_{SRing}}{2 \times H_{ring} \times \sigma_{zul}}$$

a_{RiRip} = 1,72 [mm] < $a_{RiRipgew}$ = 3,0 [mm]

Picture 4-23: Excel calculation of the welding seam (Ring – Ribs)

4.6.1.3 Welding seam (Shaft – ribs)

3.16.4 Wellenzapfen - Rippe



$\sigma_b =$ 59,4 [N/mm²]

K-Naht, D52-Linie *Beanspruchungskl. E7, wechselnd*

$$\sigma_b = \frac{M_b}{W_b} \qquad M_b = F_{SRing} \times (L_{rippe} + B_{ring} / 2)$$

$$a_{SWZmin} = \frac{Mb \times 3}{\sigma_b \times L_{SWZ}^2} \qquad W_b = 2 \times a_{SWZmin} \times L_{SWZ}^2 / 6$$

$a_{SWZmin} =$ 7,22 [mm] < $a_{SWZgew} =$ 7,5 [mm]

Picture 4-24: Excel calculation of the welding seam (Shaft – Ribs)

4.6.1.4 Drum thickness according to Ernst

3.10 Trommeldicke nach Ernst

Einstufung alt lt. ÖNORM B4004:	ψ_{alt} =	1,38	
Seiltrommeldicke:	h_{Tr} =	11,00	[mm]
Nachbearbeitungszugabe:	h_{nTr} =	5,00	[mm]
Trommeldurchmesser:	D_{Tr} =	1000,00	[mm]
Seilrillensteigung:	s_{SR} =	27	[mm]

$$\sigma_a = \frac{0{,}5 \times F_{Sl} \times \psi_{alt}}{s_{SR} \times h_{Tr}}$$

σ_a = 168,6 [N/mm²]

$$\sigma_{ba} = \frac{0{,}96 \times F_{Sl} \times \psi_{alt}}{h_{Tr} \times \sqrt{[(D_{Tr} - 2 \times h_{nTr}) \times h_{Tr}]}}$$

σ_{ba} = 83,8 [N/mm²]

Zul. Werte mit 5/3 multipliziert, da schwellende Beanspruchung
Wert jedoch mit 215 N/mm² begrenzt

Beanspruchungskl. E5, B-Linie, schwellend

$\sigma_{ges} = \sqrt{(\sigma_a^2 + \sigma_{ba}^2 - 2 \times \sigma_a \times \sigma_{ba})}$ Werkstoff: St510

σ_{ges} = 146,0 [N/mm²] < σ_{zul} = 198,00 [N/mm²]

Picture 4-25: Excel calculation of the drum thickness according to Ernst

4.6.1.5 Drum thickness according to Scheffler

3.12 Trommeldicke nach Scheffler

Trommel zu Seildurchmesser:	D_{Tr}/d_{Seil}	41,7	[oE]
Faktor für die Anzahl der Übereinandergewickelten Lagen (1-lagig):	φ_f =	0,927	[oE]
Faktor zur Bestimmung von Seilrillenhöhe zu Trommeldicke:	φ_R =	0,824	[oE]
Faktor zur Berücksichtigung des Elastizitätsmoduls des Seils:	φ_E =	1	[oE]
Füllgrad des Seils:	k =	0,619	[oE]
Faktor für Füllgrad:	φ_k =	0,974	[oE]
Seilrillensteigung zu Seildurchmesser:	s_{SR}/d_{Seil} =	1,125	[oE]
Dazugehöriger Faktor:	φ_s =	0,901	[oE]
Wert bei 1-lagigen Seiltrommeln immer 1:	φ_d =	1	[oE]
Trommeldicke gewählt:	h_{Tr} =	11,00	[mm]
Seildurchmesser gewählt:	d_{Seil} =	24,00	[mm]

$$\sigma_{Scheffler} = \frac{F_{SI} \times \varphi_d \times \varphi_R \times \varphi_E \times \varphi_k \times \varphi_s \times \varphi_d}{h_{Tr} \times d_{Seil}}$$

$\sigma_{Scheffler}$ = 184,4 [N/mm²] < σ_{zul} = 198,00 [N/mm²]

Picture 4-26: Excel calculation of the drum thickness according to Scheffler

4.6.1.6 Minimum shaft extension diameter

3.13 Wellenzapfendurchmesser

Abstand Seiltrommel - Trommellager:	L_{lag} =	110,00	[mm]
Bordscheibendicke = Schweißnahtdicke:	s_{bord} =	30,00	[mm]
Einstufung:	ψ_{alt} =	1,38	[oE]
Lagerkraft:	F_{TrLag} =	78865,8	[N]
Werkstoff: S355 *Beanspruchungskl. E7, C-Linie, wechselnd*	σ_{zulDIN} =	53	[N]

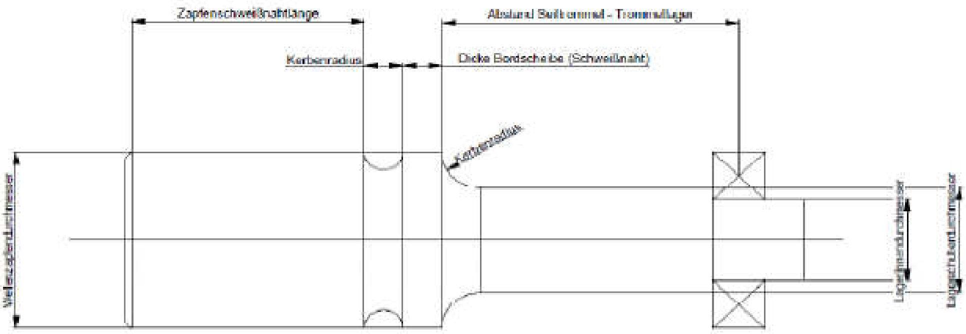


Bild4: Wellenzapfen im Bereich Schweißnaht Bordscheibe

$$d_{wzamin} = \frac{(F_{TrLag} \times (s_{bord} / 2 + L_{lag}) \times \psi_{alt})^{1/3}}{(\pi \times \sigma_{zulDIN}/32)^{1/3}}$$

d_{wzamin} = 137,7 [mm] < d_{wzagew} = 150,00 [mm]

Picture 4-27: Excel calculation of the minimum shaft extension diameter at the welding seam to the flanged wheel

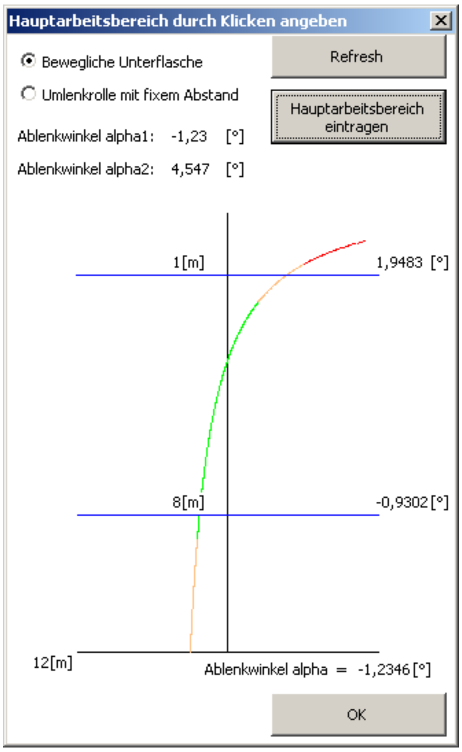
5 Potentials of the program

The main potential of the program is the fast modeling of new hoisting drums and thereby the cost saving factor. Also the security of an automated calculation, which prevents the user from making simple mistakes like transcribing errors, is a big advantage. Another thing would be the easy extensibility of the project which allows everybody to add new features to the program or the hoisting drum.

5.1 Advantages

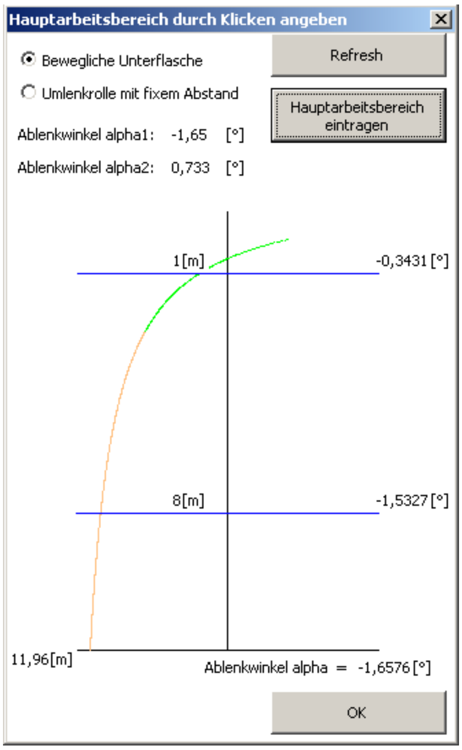
The possibility to model a new hoisting drum in a few steps obviously bears several advantages. The most important one might be the cost saving potential. First estimations allows one to assume that a decrease of approximately 80% or more of designing time can be saved. This is due to the fact that a design engineer doesn't have to calculate every part (e.g., coupling size, drum thickness...) by hand, but only has to enter the key parameters. Also the recalculation of eventually changing parts (e.g. changing drum diameter → changing torque → changing coupling size) is done in a short time. The same is with the modeling / remodeling of the parts themselves which is omitted completely in most cases. A third big advantage is the simple and fast check, if the hoisting drum needs to be remodeled because the deflecting angle is too high and thereby the drum would be worn out very fast. Respectively the drum type could be changed for example from outside to inside clamping, to avoid the same problem.

An example shows the next picture. Here the deflecting angle is in the red area (Angle over 2.5 degree) and therefore changes to the drum geometry are necessary. There are different possibilities to do so. The first one would be to increase the drum diameter. Due to this, the necessary length of the drum gets smaller and the position of the windings is more variable and therefore the delfecting angle improves. Another possibility is to change the distance of the deflection sheaves on the bottom part of the pulley. A third option would be to change the type of drum (e.g. from outside to inside clamping). Another way would be to change the clamping type from drum clamping to flanged wheel clamping. And last but not least to reposition the windings in the drum if there is enough space available.



Picture 5-1: Bad deflecting angle

In this case just the distance of the deflection sheaves on the bottom part of the pulley has been changed. The outcome is visible in the following picture.



Picture 5-2: Improved deflecing angle

5.2 Restrictions

The program also faces some restrictions, which could be attributed to the calculating fundamentals, the used programs or other factors.

5.2.1 Due to the calculating fundamentals

The calculating fundamentals described in chapter 2.4.2 on page 17ff bare some restrictions due to different reasons.

5.2.1.1 Scheffler, drum thickness

For one the diagrams used for the calculation of the drum thickness according to Scheffler only work for a ratio of the drum diameter to the cable diameter in the range from 15 to 60. But also the single diagrams have different restrictions, for example the factor for the height of the cable grooves to the drum thickness just has a range from 0.25 to 1 as well as the factor for the cable groove gradient to the cable diameter ranges from 1.05 to 1.2 (Problematic with a drum type with two parallel cables!). See Picture 8-10: Factors for calculation of the drum thickness depending on the ratio dT/dS on page 146.

5.2.1.2 Niemann, key feather size

In this case the diagram for the length factor which is needed to calculate the occurring flank pressure has a restriction due to the ratio of the shaft length to the shaft diameter which only ranges from 0.5 to 2. Also the ratio of the hub substitution diameter to the shaft diameter only ranges from 1.15 to 3. See Picture 8-7: Length factor k1 according to DIN 6892; Load intro / deduction "front", "middle", "back" on page 143.

5.2.1.3 CEN/TS 13001 – 3, cable diameter

In this calculation method the only diagrams that have restrictions are the ones concerning the deflecting angle, which ranges from 0.5° to 4° and the ratio of the radius of the cable grooves to the cable diameter which ranges from 0.53 to 1. Anyway in both cases no value should exceed those given in the diagrams, in the first case the deflecting angle should not be higher than 2.5° and it's nearly impossible to have one below 0.5° and in the second case the cable grooves are standardized according to DIN 15061 and thereby should never reach the according limits.

5.2.2 Due to the standards

The standard sometimes limit the range of certain values and / or sizes of special parts and thereby restricts the field of action.

5.2.2.1 Cable clamps

The standard SEB 666211 only describes the dimensions of cable clamps for cables in the range from 10mm to 42mm; other sizes would have to be extrapolated. In this use case it's not a problem, because the used cable diameters never exceed these values.

5.2.2.2 Coupling sizes

Similar to the cable clamps, the coupling sizes are also limited to a range of SG 130 to SG 400 (Standard SEB 666212). Anyway the current coupling manufacturer exceeded this limitation by creating coupling sizes which are two sizes bigger, six sizes smaller and three sizes more in between the range of the standard.

5.2.3 Due to the used software

Basically the only limitation in this case is because of the drawing program Inventor. The disadvantages of this program are:

- iLogic is not connected with the 2D drawing module, therefore the construction drawings can't be automated.
- Every rule has to be written in the assembly module. If the rules are added at the single parts, they are not updated automatically when the whole file is refreshed, every part would have to be updated explicitly by opening it.
- The rules can't be updated simultaneously with the drum lengths and diameters because the possibility exists that they interfere with each other and then the updating process takes several minutes or could even lead to a breakdown of the system.

5.2.4 Due to the preconditions

One of the preconditions when creating this program was that the user has every possibility of modeling the hoisting drum. Meaning that even if for example a certain minimum coupling size is required (Due to the torque or radial force), the user is still able to select a smaller one.

Excluded from these conditions is the amount of cable clamps when the drum type is set to "drum clamping". Then the amount of cable clamps is set to three and can't be changed.

5.2.5 Due to the manufacturer

The catalogue for the bearings is chosen from the company SKF which correlates with the standard DIN 635-2 (DIN, 2009) and therefore the calculation material and the bearing sizes are referring to this manufacturer. The sizes are also limited from 20mm to 240mm for the inside diameter which is quiet enough because these boundaries are usually never reached.

5.2.6 Due to the drawing of the cable groove drafts

The drafts for the cable grooves were drawn in that way, so that their starting position is fixed to the passage from where the grooves start and in the other direction the clamping starts (See chapter 3.3.2.5The drum on page 84). Due to this the reserve windings can't be chosen in split steps of a whole if the drum type is double and inside clamping. Every other case is possible.

5.3 Possibilities of the design engineer

After modeling the hoisting drum with this program the design engineer still has every possibility of adding, excluding or remodeling features or parts to his / her wishes. When the engineer is finished with his / her work, he / she should save the whole project to an explicit folder so that nobody can tamper with the settings (In this case the files will be saved on a server with SAP). If anyhow the engineer later wants to make changes to the hoisting drum, he / she is always able to do so by starting the calculation and pushing the button "Berechnung ändern". This is also possible if any manual changes have been made (e.g. adding thread holes, are cut – outs).

5.4 Extensibility of the program (interfaces…)

It is always possible that in the future somebody wants to make changes to the program. For example it is necessary to use a different kind of coupling, the calculation method for the key feather has changed or new features have to be added.

In this case changing the programming code or improving it, might be the simplest of these tasks, by just rewriting the concerning code or adding new routines.

To change the calculation method is not that simple anymore. In order to do so, the place of where the calculation is written can be reused as long as the necessary parameters are staying the same. If this is not the case, the new parameters have to be added to the bottom of the second or respectively the sixth column of the Excel sheet "Berechnung".

To add a new feature, an engineer has to program certain features to the VBA code, (e.g., different types of how the shaft extension is fixed to the flanged wheel) add the steering parameters to the Excel sheet "Tabelle1", link these parameters to the drafts (Or even draw new ones), create the new parts and connect them with rules in iLogic.

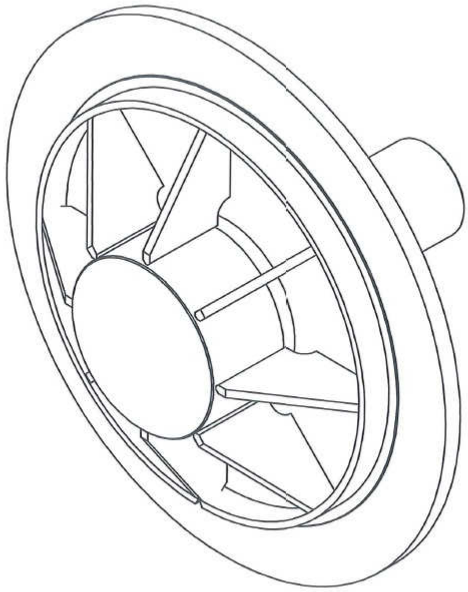
6 Summary

To sum up all the possibilities, advantages and disadvantages, it is safe to say that this program is a powerful tool to model hoisting drums in the intended field of action. As far as the drum always looks somehow similar and no major remodeling steps are necessary, the goal of a fast, safe and easy generation is definitely fulfilled. The minor disadvantages don't really affect the creating process as far as the user enters realistic values and is an engineer who has at least a little experience in this field of expertise. The software, calculating methods and used machine elements are well known, up to date and thereby don't face the possibility of being replaced in the near future, but even if so, it would not be to much work necessary to adapt to a future version of Excel, Inventor, calculating method or e.g. coupling type. The results have been verified by several coworkers and / or external sources to guarantee a maximum of safety and liability. The first "in the field" test proved to be successful and therefore the program is just waiting for deployment.

6.1 Future development

Future development in this direction could be the redesigning of the way how the shaft extension is connected to the drum. The idea behind this is of course the cost saving factor and the lowering of the drum weight without decreasing the structural integrity. The weight was calculated and the manufacturing costs were approximated by Mr. Jürgen Kaineder from voestalpine (department B4M). The following pictures of the shaft extension are made out of an already existing hoisting drum with a diameter of 800mm and a used cable diameter of 33mm.

6.1.1 Current design of the connection of the shaft extension



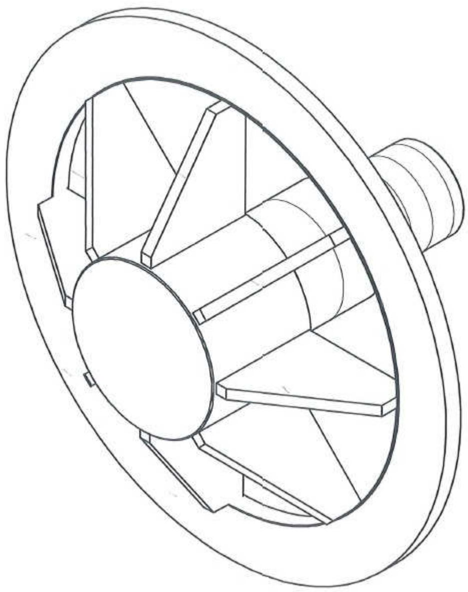
Picture 6-1: Current design of the connection of the shaft extension

The current design includes eight ribs and a ring with a thickness of 10mm, the flanged wheel has a thickness of 30mm.

Weight of the parts as shown in Picture 6-1: 366.8kg

Manufacturing and assembling costs: € 10.080.-

6.1.2 Shaft extension without a continuous flanged wheel



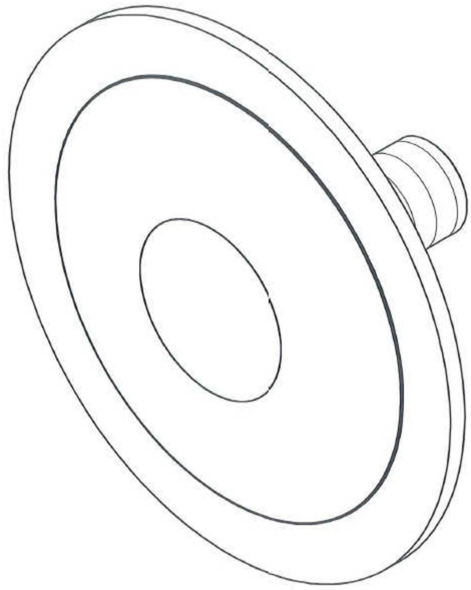
Picture 6-2: Shaft extension without a continuous flanged wheel

In this case the connection has been modified in that way, so that the flanged wheel is just for safety reasons on the outside (The inside part has been removed), so that the cable can't fall of the drum. The thickness of the ribs was increased to 20mm and the notch at the shaft has been removed, the rest of the drum stays the same. The thought behind this design is, that for example a wheel of a car also has no continuous flanged wheel but only spokes.

Weight of the parts as shown in Picture 6-2: 286kg

Manufacturing and assembling costs: € 9.480.-

6.1.3 Flanged wheel without ribs



Picture 6-3: Flanged wheel without ribs

In this mock – up the ribs have been removed completely and the flanged wheel has been thickened at the bottom to the extent of 70mm, the outside stays the same (30mm). Therefore the shaft has been shortened for the same amount and the notch has also been removed.

Weight of the parts as shown in Picture 6-3: 308,5kg

Manufacturing and assembling costs: € 10.100.-

The shortfall in this case is, that the seam itself has a thickness of 70mm and therefore is hard to manufacture. This kind of connection might be useful with smaller drum sizes.

6.1.4 Conclusion of these different mock – ups

The outcome of this study was, that concerning the costs it doesn't really matter which type of connection is used. Referring to the distribution of the stress it might be useful to use the mock – up without ribs. But this can only be done with small drum sizes because of the thickness of the welding seam. If the drum should be as lightweight as possible, the setup with only ribs is the best one, but here the stress has to be checked thoroughly.

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7.2 Table of pictures

7.3 Table of formulas

8 Annex

8.1 Annex 2 – Additional information

8.1.1 DIN 15020 – 1

Tabelle 1. Triebwerkgruppen nach Laufzeitklassen und Lastkollektiven 1)

Laufzeitklasse	Kurzzeichen			V_{006}	V_{012}	V_{025}	V_{05}	V_1	V_2	V_3	V_4	V_5
	mittlere Laufzeit je Tag in h, bezogen auf 1 Jahr			bis 0,125	über 0,125 bis 0,25	über 0,25 bis 0,5	über 0,5 bis 1	über 1 bis 2	über 2 bis 4	über 4 bis 8	über 8 bis 16	über 16
Lastkollektiv	Nr	Benennung	Erklärung	Triebwerkgruppe								
	1	leicht	geringe Häufigkeit der größten Last	$1E_m$	$1E_m$	$1D_m$	$1C_m$	$1B_m$	$1A_m$	2_m	3_m	4_m
	2	mittel	etwa gleiche Häufigkeit von kleinen, mittleren und größten Lasten	$1E_m$	$1D_m$	$1C_m$	$1B_m$	$1A_m$	2_m	3_m	4_m	5_m
	3	schwer	nahezu ständig größte Lasten	$1D_m$	$1C_m$	$1B_m$	$1A_m$	2_m	3_m	4_m	5_m	5_m

Bei einer Dauer eines Arbeitsspieles von 12 Minuten oder mehr darf der Seiltrieb um 1 Triebwerkgruppe niedriger gegenüber der Triebwerkgruppe eingestuft werden, die aus Laufzeitklasse und Lastkollektiv ermittelt wird.

1) Diese Tabelle kann entfallen, sobald eine entsprechende, für alle Triebwerke gültige Norm aufgestellt ist.

2) Siehe Seite 9

Picture 8-1: Tabular 1, selecting the mechanism group

Tabelle 2. **Beiwerte** *c*

Triebwerkgruppe	c in mm/$\sqrt{N}$ für übliche Transporte und nicht drehungsfreie Drahtseile					übliche Transporte und drehungsfreie bzw. drehungsarme Drahtseile 3)			gefährliche Transporte 4) und nicht drehungsfreie Drahtseile			gefährliche Transporte 4) und drehungsfreie bzw. drehungsarme Drahtseile 3)		
	Nennfestigkeit der Einzeldrähte in N/mm²													
	1570	1770	1960	2160 5)	2450 5)	1570	1770	1960	1570	1770	1960	1570	1770	1960
$1E_m$	—	0,0670	0,0630	0,0600	0,0560	—	0,0710	0,0670	—			—		
$1D_m$	—	0,0710	0,0670	0,0630	0,0600	—	0,0750	0,0710	—			—		
$1C_m$	—	0,0750	0,0710	0,0670		—	0,0800	0,0750	—			—		
$1B_m$	0,0850	0,0800	0,0750	—		0,0900	0,0850	0,0800	—			—		
$1A_m$	0,0900	0,0850		—		0,0950		0,0900	0,0950			0,106		
2_m	0,0950			—		0,106			0,106			0,118		
3_m	0,106			—		0,118			0,118			—		
4_m	0,118			—		0,132			0,132			—		
5_m	0,132			—		0,150			0,150			—		

Bei den Triebwerksgruppen $1E_m$, $1D_m$ und $1C_m$ ist durch Auflegen entsprechender Seile dafür zu sorgen, daß zusätzlich das Verhältnis der rechnerischen Seilbruchkraft zur rechnerischen Seilzugkraft nicht kleiner ist als 3,0.

3) Bei Serienhebezeugen dürfen für drehungsfreie bzw. drehungsarme Drahtseile die gleichen Beiwerte *c* benutzt werden wie für nicht drehungsfreie Drahtseile, wenn durch die Wahl der Seilkonstruktion eine ausreichende Aufliegezeit erreicht wird.

4) Z. B. Befördern feuerflüssiger Massen, Befördern von Reaktor-Brennelementen. Bei Serienhebezeugen kann auf diese Einstufung verzichtet werden, wenn unter Beibehaltung von Drahtseil-, Seiltrommel- und Seilrollen-Durchmesser die Seilzugkraft auf $^2/_3$ des Wertes für übliche Transporte herabgesetzt wird.

5) Besonders Drahtseile von 2160 und 2450 N/mm² Nennfestigkeit müssen von solcher Konstruktion sein, daß sie für den vorliegenden speziellen Anwendungsfall geeignet sind.

Picture 8-2: Tabular 2, factor c

Tabelle 4. **Beiwerte** h_1

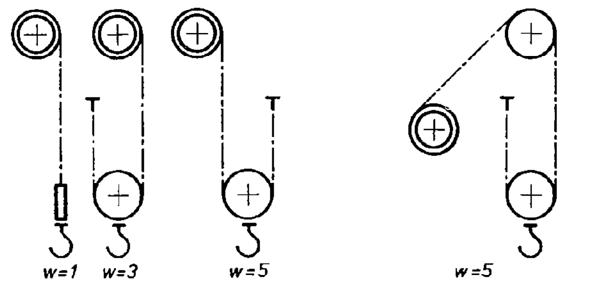
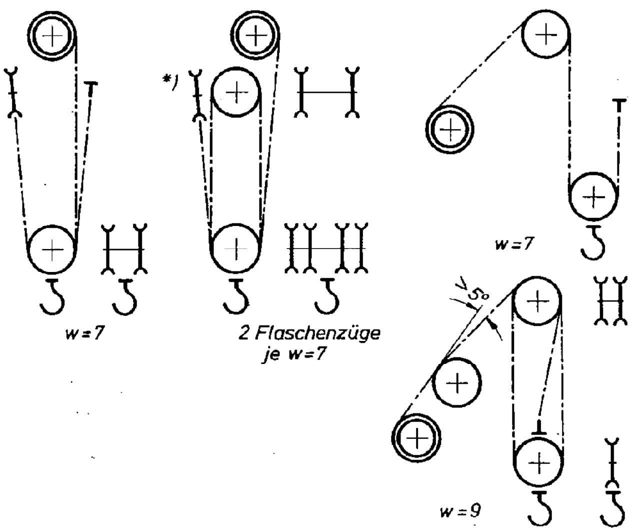
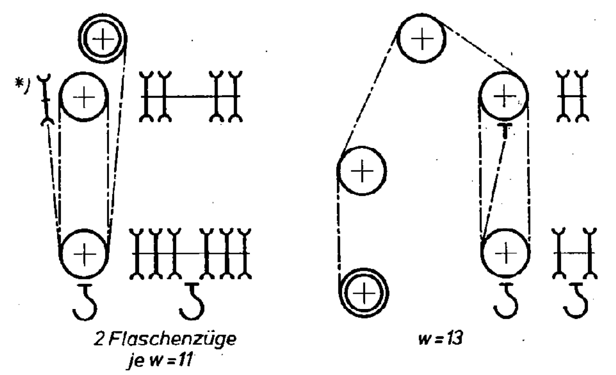
Triebwerkgruppe	h_1 für Seiltrommel und nicht drehungsfreie Drahtseile	Seiltrommel und drehungsfreie bzw. drehungsarme 6) Drahtseile	Seilrolle und nicht drehungsfreie Drahtseile	Seilrolle und drehungsfreie bzw. drehungsarme 6) Drahtseile	Ausgleichrolle und nicht drehungsfreie Drahtseile	Ausgleichrolle und drehungsfreie bzw. drehungsarme 6) Drahtseile
$1E_m$	10	11,2	11,2	12,5	10	12,5
$1D_m$	11,2	12,5	12,5	14	10	12,5
$1C_m$	12,5	14	14	16	12,5	14
$1B_m$	14	16	16	18	12,5	14
$1A_m$	16	18	18	20	14	16
2_m	18	20	20	22,4	14	16
3_m	20	22,4	22,4	25	16	18
4_m	22,4	25	25	28	16	18
5_m	25	28	28	31,5	18	20

Seilrollen in Greifern dürfen unabhängig von der Einstufung des übrigen Seiltriebes nach Triebwerkgruppe $1B_m$ bemessen werden.

6) Bei Serienhebezeugen dürfen für drehungsfreie bzw. drehungsarme Drahtseile die gleichen Beiwerte h_1 benutzt werden wie für nicht drehungsfreie Drahtseile, wenn durch die Wahl der Seilkonstruktion eine ausreichende Aufliegezeit erreicht wird.

Picture 8-3: Tabular 4, factor h_1

Tabelle 5. **Beiwerte h_2**

<table>
<tr><th colspan="2">Anordnungsbeispiele von Seiltrieben</th><th rowspan="2">w</th><th colspan="2">h_2 [7]) für</th></tr>
<tr><th>Beschreibung</th><th>Anwendungsbeispiele
(Trommeln sind in Doppellinien angegeben)</th><th>Seil-trommeln, Ausgleich-rollen</th><th>Seil-rollen</th></tr>
<tr><td>Drahtseil läuft auf Seiltrommel und über höchstens
2 Seilrollen mit gleichsinniger Biegung
oder
1 Seilrolle mit Gegenbiegung</td><td>
</td><td>bis 5</td><td>1</td><td>1</td></tr>
<tr><td>Drahtseil läuft auf Seiltrommel und über höchstens
4 Seilrollen mit gleichsinniger Biegung
oder
2 Seilrollen mit gleichsinniger und 1 Seilrolle mit Gegenbiegung
oder
2 Seilrollen mit Gegenbiegung</td><td>
</td><td>6 bis 9</td><td>1</td><td>1,12</td></tr>
<tr><td>Drahtseil läuft auf Seiltrommel und über mindestens
5 Seilrollen mit gleichsinniger Biegung
oder
3 Seilrollen mit gleichsinniger und 1 Seilrolle mit Gegenbiegung
oder
1 Seilrolle mit gleichsinniger und 2 Seilrollen mit Gegenbiegung
oder
3 Seilrollen mit Gegenbiegung</td><td>
</td><td>ab 10</td><td>1</td><td>1,25</td></tr>
<tr><td colspan="5">Für Seilrollen in Serienhebezeugen und Greifern kann unabhängig von der Anordnung des Seiltriebes $h_2 = 1$ gesetzt werden.</td></tr>
<tr><td colspan="5">*) Ausgleichrolle
7) Zuordnung von w und h_2 zu Beschreibung und Anwendungsbeispielen gilt nur, wenn e i n Seilstück während eines Arbeitshubes die gesamte Anordnung des Seiltriebes durchläuft. Für die Ermittlung von h_2 brauchen nur die am ungünstigsten Seilstück auftretenden Werte w berücksichtigt zu werden.</td></tr>
</table>

Picture 8-4: Tabular 5, factor h_2

8.1.2 SEB 666212 – 2

Kurzbe-zeichnung	$K_{zul.}$
SG 130	2,47
SG 140	3,90
SG 185	7,20
SG 200	12,3
SG 240	18,5
SG 270	32,0
SG 315	41,0
SG 355	51,5
SG 400	70,5

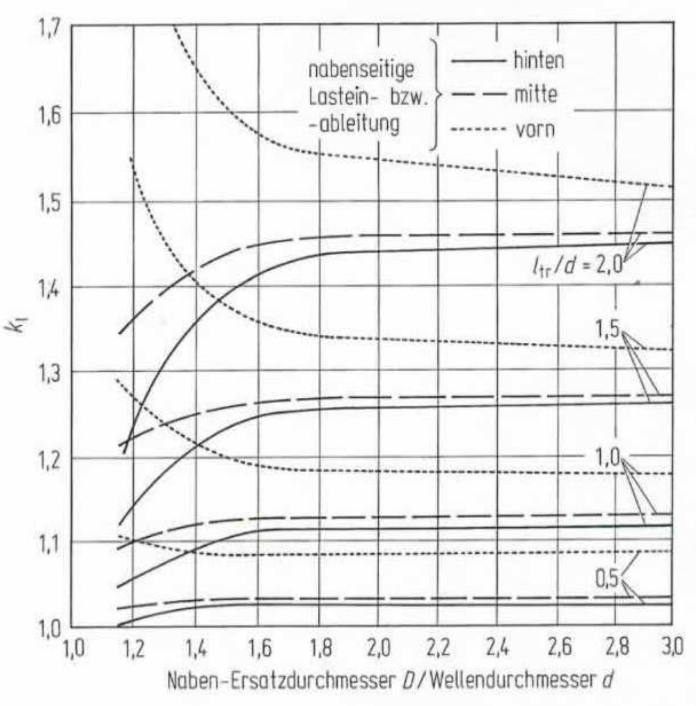
Picture 8-5: Valid K_{zul} factors according to the coupling size

8.1.3 Malmedie TTXs

Size	Selection SEB	Torque Tk max [Nm]	Radial load Fr max [N]
0,25	-	6500	17500
0,5	-	8000	20000
0,75	-	9500	21500
1	-	16000	27000
1,3	-	21000	37000
1,6	-	26000	41000
2	SG 130	30000	45000
3	-	41000	53000
4	SG 140	54000	75000
5	-	77000	115000
6	SG 185	120000	130000
10	SG 200	180000	150000
15	SG 240	240000	180000
21	-	330000	265000
26	SG 270	410000	315000
34	SG 315	520000	360000
42	SG 355	650000	400000
62	SG 400	770000	475000
82	-	930000	525000
92	-	1100000	550000

Picture 8-6: Dimension sheet 709-04 / TTXs Standard

8.1.4 Feather key calculation according to Niemann



Picture 8-7: Length factor k1 according to DIN 6892; Load intro / deduction "front", "middle", "back"

The initiation of the load takes place on the front of the connection.

8.1.5 Cable clamps

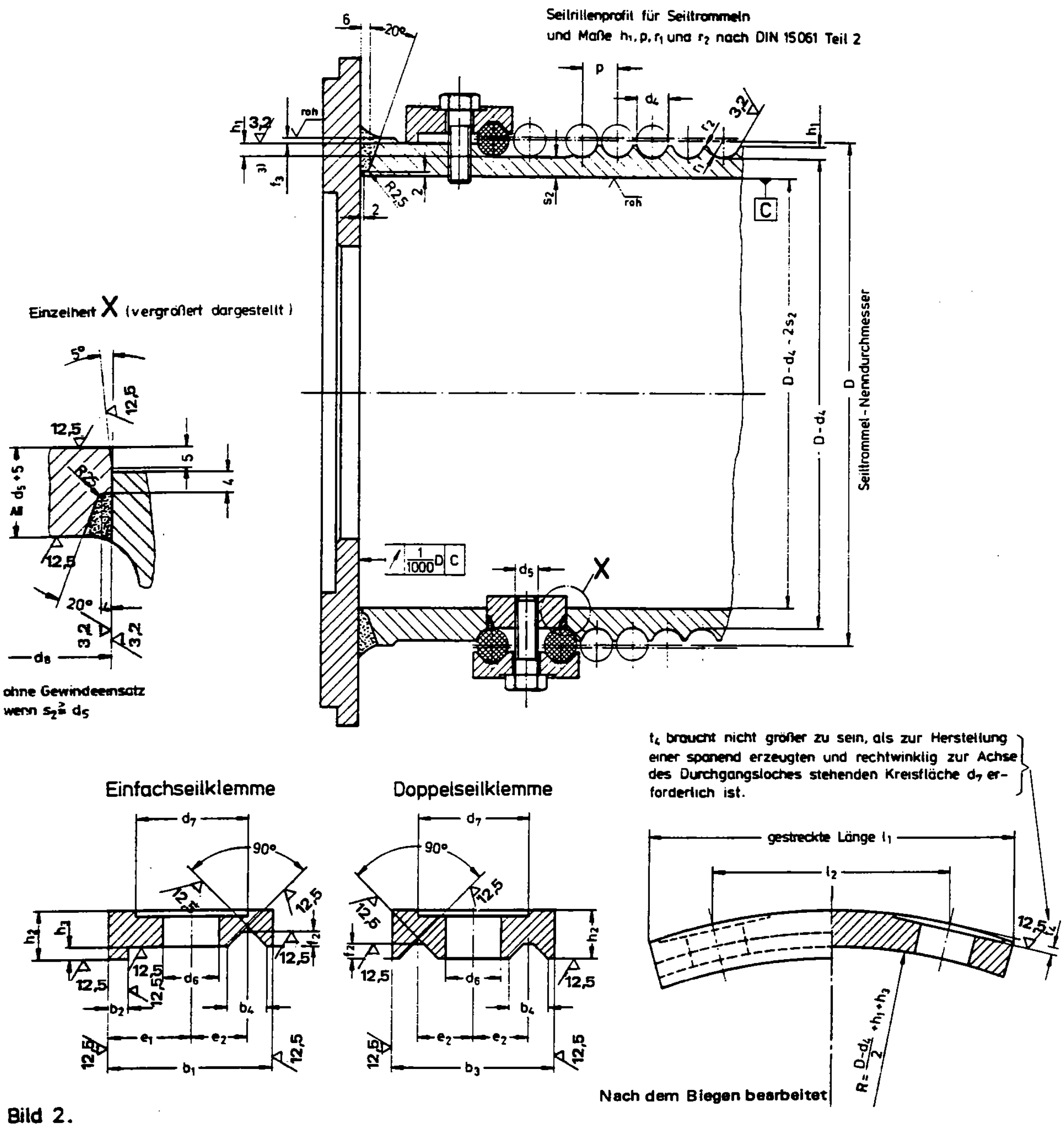


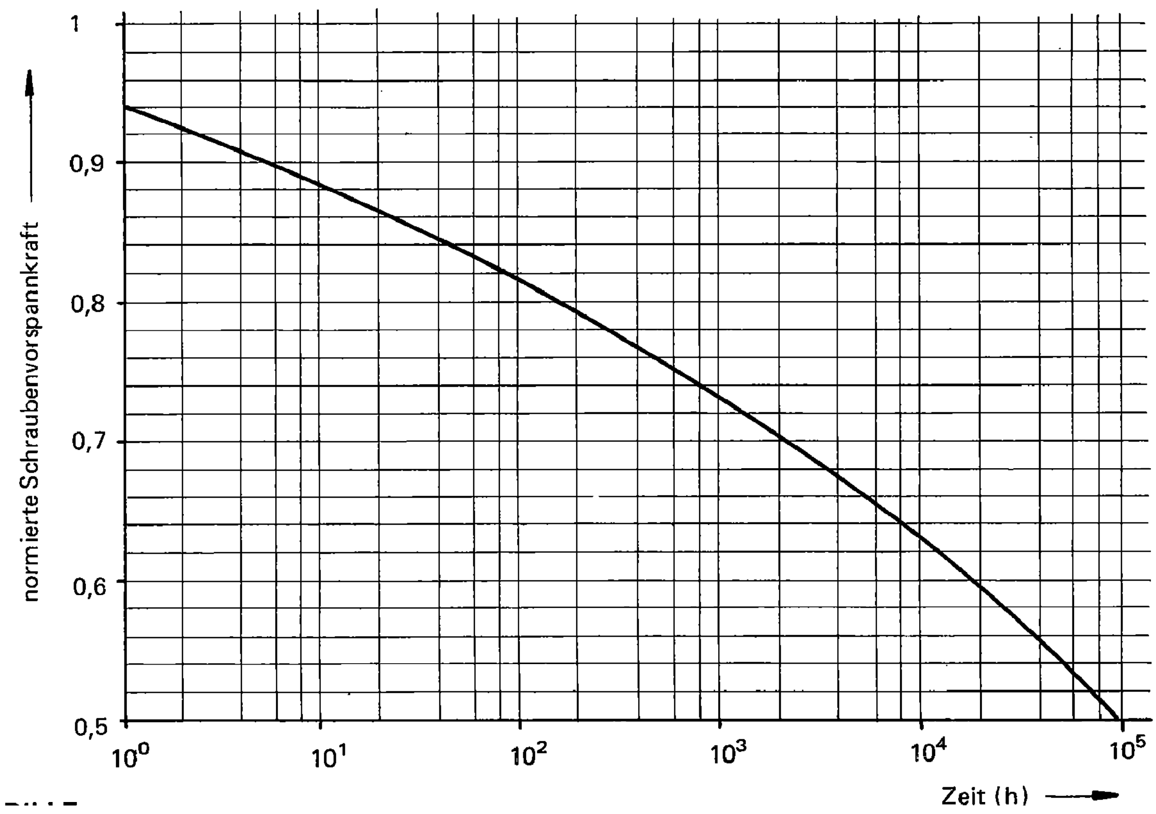
Bild 2.

Tabelle 3.

Seil-Nenn-durchmesser d_4	b_1	b_2	b_3	b_4	d_5	Anzieh-drehmoment Nm	d_6	d_7	d_8 H7 m6	e_1	e_2	f_2	h_1 min	h_2	h_3	l_1	l_2 +0,5	p	r_1	r_1 zul. Abw.	r_2 min	s_2 min
10	40	5	41	10	M 12	86	15	28	35	20	14	3,5	4	12	3	100	65	11,5	5,3	+0,2	0,8	8
11	42	5	42	11	M 12	86	15	28	35	21	14	4	4,5	12	3,5	100	65	13	6		0,8	8
12	45	6	45	12	M 12	86	15	28	35	22	15	4,5	4,5	13	4	110	70	14	6,5		0,8	8
13	50	6	48	13	M 12	86	15	28	35	25	16	4,5	5	13	4,25	110	70	15	7		0,8	8
14	55	6	56	14	M 16	210	19	36	45	27	19	5	5,5	17	4,5	130	80	16	7,5		0,8	11
16	60	8	60	16	M 16	210	19	36	50	30	20	5,5	6	17	5,25	130	80	18	8,5		0,8	11
18	65	8	64	18	M 16	210	19	36	50	33	21	6,5	7	18	6	130	80	20	9,5		0,8	11
20	70	8	72	20	M 20	410	24	43	60	34	24	7	7,5	22	6,75	160	105	22	10,5		0,8	14
22	75	10	76	22	M 20	410	24	43	65	36	25	8	8,5	22	7,5	160	105	25	12		0,8	14
24	80	10	80	24	M 20	410	24	43	65	39	28	9	9	23	8	160	105	27	13		0,8	14
26	85	10	86	26	M 20	410	24	43	70	41	27	9	10	23	8,5	160	105	29	14		0,8	14
28	90	10	98	28	M 24	710	28	50	80	41	31	10	10,5	28	9,5	200	130	31	15		0,8	17
32	95	10	106	32	M 24	710	28	50	85	43	33	11	12	28	10,5	200	130	36	17	+0,4	1,3	17
36	110	10	124	36	M 30	1450	35	66	100	47	39	13	13,5	35	12,5	250	170	40	19		1,3	21
40	115	10	132	40	M 30	1450	35	66	105	49	41	14	15	35	13,5	250	170	44	21		1,6	21

3) Schnittzugabe f_3 für Seiltrommel-Nenndurchmesser D bis 630 ≥ 2, über 630 bis 1000 ≥ 2,5, über 1000 ≥ 3.

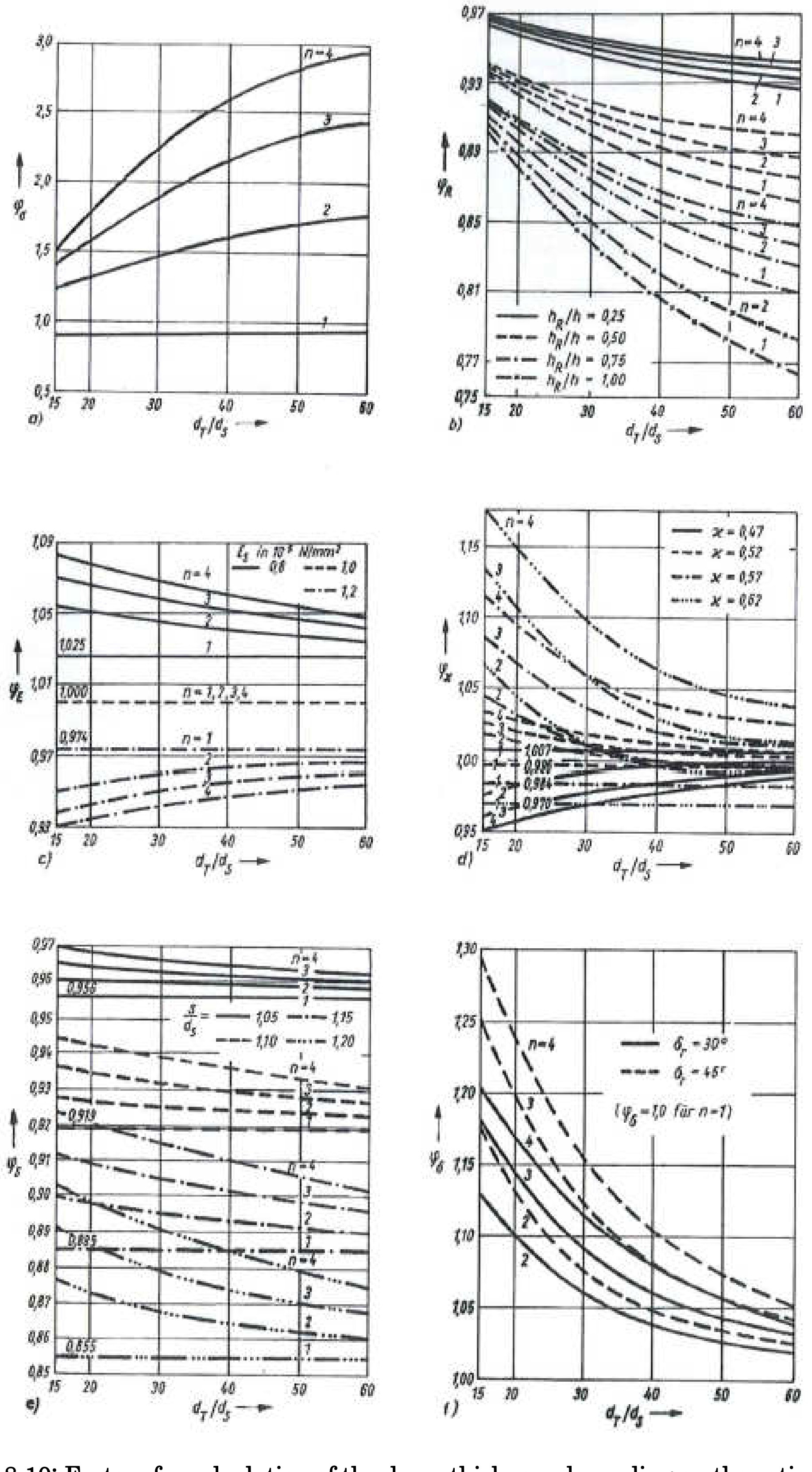
Picture 8-8: SEB 666211



Picture 8-9: Standardized preloaded screw force, SEB 666211 – 1

Picture 8-9 shows the time dependent standardized preloaded screw force for cables with steel cores. For cables with fiber cores a better trend was determined. If the factor 1.8 ($\triangleq \frac{1}{0,55}$ in Picture 8-9) for the shrinkage behavior is applied, like in chapter 2.4.2.5.1Clamping on the drum (double clamps) on page 24, a running time of five years can be read out.

8.1.6 Drum thickness according to Scheffler



Picture 8-10: Factors for calculation of the drum thickness depending on the ratio d_T/d_S

8.1.7 CEN / TS 13001 – 3

Klasse	S_R0	S_R1	S_R2	S_R3	S_R4	S_R5	S_R6	S_R7	S_R8	S_R9
s_r	0,008	0,016	0,032	0,063	0,125	0,25	0,5	1,0	2,0	4,0

Picture 8-11: s_R classifications

Auf- und Ablaufwinkel δ	Nicht drehungsfreie Seile	Drehungsfreie Seile
$\leq 0{,}5°$	1,0	1,0
1,0°	0,9	0,9
2,0°	0,75	0,7
3,0°	0,7	Nicht vorgesehen
4,0°	0,67	
Zwischenwerte dürfen interpoliert werden.		

Picture 8-12: Factor f_{f3}

r_g/d	ω	f_{f6}
0,53	$\leq 60°$	1
0,55		0,84
0,6	Keine Anforderungen	0,75
0,7		0,63
0,8		0,58
$\geq 1{,}0$		0,54
Zwischenwerte dürfen interpoliert werden.		

Picture 8-13: Factor f_{f6}

8.2 Annex3 – Program code

8.2.1 VBA – Code

8.2.1.1 Pressing the button "Berechnung starten"

```
Private Sub CommandButton1_Click()


'Falls die Berechnung zuvor abgeschlossen wurde,  wird der Butten "Berechung
ändern freigegeben
```

```
If Worksheets("Berechnung").Cells(82, 2).Value <> "" Then
   ufmSeiltrommelart.CommandButton3.Enabled = True
Else
   ufmSeiltrommelart.CommandButton3.Enabled = False
End If

ufmSeiltrommelart.Show

End Sub
```

8.2.1.2 ufmAblenkwinkel

```
Option Explicit

Public TextB8 As Double
Public TextB3 As Double
Public TextB4 As Double
Public Delta2 As Double
Public TB8 As Double
Public d_zuvor As Double

Private Sub ComboBox5_Change()

   Dim i As Integer

   ComboBox7.Clear
   ComboBox6.Clear

   Worksheets("Berechnung").Cells(42, 6).Value = ComboBox5.Value

   For i = 2 To Worksheets("Pendelrollenlager").Cells(65536, 1).End(xlUp).Row
      If Worksheets("Pendelrollenlager").Cells(i, 1).Value = ComboBox5.Text And Work-
sheets("Pendelrollenlager").Cells(i, 2).Value <> d_zuvor Then
         ComboBox6.AddItem Worksheets("Pendelrollenlager").Cells(i, 2).Value
         d_zuvor = Worksheets("Pendelrollenlager").Cells(i, 2).Value
      End If
   Next i

   ComboBox6.BackColor = &H80000005
```

```
    ComboBox7.BackColor = &HE0E0E0
    ComboBox6.Enabled = True
    ComboBox7.Enabled = False

End Sub

Private Sub ComboBox6_Change()
    Dim i As Integer
    Dim x As Double

    ComboBox7.Clear

    Worksheets("Berechnung").Cells(81, 2).Value = ComboBox6.Value

    For i = 2 To Worksheets("Pendelrollenlager").Cells(65536, 1).End(xlUp).Row
        If Worksheets("Pendelrollenlager").Cells(i, 1).Value = ComboBox5.Text And Worksheets("Pendelrollenlager").Cells(i, 2).Value = ComboBox6.Text Then

            Worksheets("Berechnung").Cells(51, 6).Value = Worksheets("Pendelrollenlager").Cells(i, 10).Value
            Worksheets("Berechnung").Cells(52, 6).Value = Worksheets("Pendelrollenlager").Cells(i, 11).Value
            Worksheets("Berechnung").Cells(53, 6).Value = Worksheets("Pendelrollenlager").Cells(i, 5).Value
            Worksheets("Berechnung").Cells(54, 6).Value = Worksheets("Pendelrollenlager").Cells(i, 4).Value

            With ComboBox7
                .AddItem
                .List(.ListCount - 1, 0) = Worksheets("Pendelrollenlager").Cells(i, 3).Value
                .List(.ListCount - 1, 1) = Worksheets("Berechnung").Cells(96, 14).Value
                .List(.ListCount - 1, 2) = Worksheets("Berechnung").Cells(98, 14).Value
            End With

        End If
    Next i

    With ComboBox7
        .ColumnWidths = "30;30;30"
        .BackColor = &H80000005
        .Enabled = True
```

```
    End With

End Sub

Private Sub ComboBox7_Change()

    Dim i As Integer
    Dim da_min As Double

    For i = 2 To Worksheets("Pendelrollenlager").Cells(65536, 1).End(xlUp).Row
        If Worksheets("Pendelrollenlager").Cells(i, 1).Value = ComboBox5.Text Then
            If Worksheets("Pendelrollenlager").Cells(i, 2).Value = ComboBox6.Text Then
                If Worksheets("Pendelrollenlager").Cells(i, 3).Value = ComboBox7.Text Then
                    'Bezeichnung des Lagers ausgeben
                    Label221.Caption = Worksheets("Pendelrollenlager").Cells(i, 7).Text
                    Worksheets("Hauptteil").Cells(870, 4).Value = Worksheets("Pendelrollenlager").Cells(i, 7).Text
                    'Lagerbreite
                    Worksheets("Tabelle1").Cells(2, 71).Value = Worksheets("Pendelrollenlager").Cells(i, 9).Text
                    'Berechnung des minimalen Wellenzapfendurchmessers (Schulterdurchmesser ausgeben)
                    da_min = Worksheets("Pendelrollenlager").Cells(i, 8).Value
                    Worksheets("Berechnung").Cells(41, 6).Value = Worksheets("Pendelrollenlager").Cells(i, 8).Text



                    If CDbl(ufmWellenzapfen.TextBox4.Value - 2 * ufmWellenzapfen.TextBox5.Value) < da_min Then
                        Label1.BackColor = &HFF&
                        ufmWellenzapfen.TextBox4.BackColor = &HFF&
                    Else
                        Label1.BackColor = &H80000018
                        ufmWellenzapfen.TextBox4.BackColor = "&H80000009"
                    End If

                    ufmWellenzapfen.Label156.Visible = True
                    ufmWellenzapfen.Label157.Visible = True
                    ufmWellenzapfen.Label158.Visible = True
                End If
            End If
```

```
        End If
    Next i

    Worksheets("Berechnung").Cells(43, 6).Value = ComboBox7.Value

    ufmWellenzapfen.Label158.Caption = da_min + 2 * ufmWellenzapfen.TextBox5.Value

    Label221.Visible = True
    Label222.Visible = True

End Sub

Private Sub CommandButton1_Click()

    Dim TBNumber As Long
    Dim Kontrolvariable As Integer
    Dim i As Long
    TBNumber = 10
    Kontrolvariable = 0

    'Falls eine TextBox ausgeblendet ist, wird der Status der Hintergrundfarbe auf weiß gesetzt
    For i = 1 To TBNumber
        If i <> 5 Then
            If Me.Controls("TextBox" & i).Visible = False Then
                Me.Controls("TextBox" & i).BackColor = "&H80000009"
            End If
        End If
    Next i
    'Überprüfung ob alle Textfelder ausgefüllt wurden
    For i = 1 To TBNumber
        If i <> 5 Then
            If Me.Controls("TextBox" & i).BackColor = &HFF& Then
                Kontrolvariable = Kontrolvariable + 1
            End If
        End If
    Next i

    If ComboBox7.Value = "" Then
        MsgBox "Bitte Pendelrollenlager wählen"
```

```
End If


If Kontrolvariable > 0 Or Label1.BackColor = &HFF& Or Label2.BackColor = &HFF& Then
    If Kontrolvariable > 0 Then
        MsgBox "Es sind " & Kontrolvariable & " Parameter nicht ausgefüllt!" & Chr(10) & "Fal-
sche Daten im Speicher!", vbOKOnly, "Error"
    End If
    If Label1.BackColor = &HFF& Then
        MsgBox "Detail A ist nicht vollständig ausgefüllt" & Chr(10) & "Falsche Daten im Spei-
cher!", vbOKOnly, "Error"
    End If
    If Label2.BackColor = &HFF& Then
        MsgBox "Detail B ist nicht vollständig ausgefüllt" & Chr(10) & "Falsche Daten im Spei-
cher!", vbOKOnly, "Error"
    End If


Else
    Aktualisiere_TextBox3
    If TextBox8.Value >= CDbl(Label33.Caption) And TextBox3.Value >=
CDbl(Label39.Caption) And TextBox4.Value >= CDbl(Label43.Caption) And TextBox10.Value
<= CDbl(Label36.Caption) And TextBox1.Value >= CDbl(Label22.Caption) Then
    Else
        If TextBox8.Value < CDbl(Label33.Caption) And TextBox8.Visible = True Then
            MsgBox "Abstand von Bordscheibe (links) ist zu klein" & Chr(10) & "Falsche Daten im
Speicher!", vbOKOnly, "Error"
        End If
        If TextBox3.Value < CDbl(Label39.Caption) And TextBox3.Visible = True Then
            MsgBox "Gesamtlänge ist zu klein gewählt" & Chr(10) & "Falsche Daten im Speicher!",
vbOKOnly, "Error"
        End If
        If TextBox4.Value < CDbl(Label43.Caption) And TextBox4.Visible = True Then
            MsgBox "Mittenlänge/Restlänge (rechts) ist zu klein gewählt" & Chr(10) & "Falsche
Daten im Speicher!", vbOKOnly, "Error"
        End If
        If TextBox10.Value > CDbl(Label36.Caption) And TextBox10.Visible = True Then
            MsgBox "Unbearbeitet Mittenlänge/Restlänge (rechts) ist zu groß gewählt" & Chr(10)
& "Falsche Daten im Speicher!", vbOKOnly, "Error"
        End If
        If TextBox1.Value < CDbl(Worksheets("Berechnung").Cells(15, 2).Value) -
CDbl(Worksheets("Berechnung").Cells(13, 2).Value) And TextBox1.Visible = True Then
            MsgBox "Unbearbeiter Trommeldurchmesser ist kleiner als bearbeiteter Trommel-
durchmesser" & Chr(10) & "Falsche Daten im Speicher!", vbOKOnly, "Error"
        End If
```

```
        End If
        ufmParametereingabe.CommandButton1.Caption = "OK"
    End If

    Werte_kopieren

    ufmAblenkwinkel.Hide
    ufmParametereingabe.Show

End Sub

Private Sub CommandButton2_Click()
    Dim TBNumber As Long
    Dim Kontrolvariable As Integer
    Dim i As Long

    TBNumber = 10
    Kontrolvariable = 0

    '"If i <> 5 then" weil TextBox 5 im nachhinein gelöscht wurde und dies den geringeren Zeitaufwand beansprucht

    For i = 1 To TBNumber
        If i <> 5 Then
            If Me.Controls("TextBox" & i).Visible = False Then
                Me.Controls("TextBox" & i).BackColor = "&H80000009"
            End If
        End If
    Next i

    For i = 1 To TBNumber
        If i <> 5 Then
            If Me.Controls("TextBox" & i).BackColor = &HFF& Then
                Kontrolvariable = Kontrolvariable + 1
            End If
        End If
    Next i

    Aktualisiere_TextBox3
```

```
If Kontrolvariable > 0 Then
    MsgBox "Es sind " & Kontrolvariable & " Parameter nicht ausgefüllt!" & Chr(10) & "Ablenkwinkel kann nicht berechnet werden!", vbOKOnly, "Error"
Else
    ufmHauptarbeitsbereich.CommandButton3.Caption = "Hauptarbeitsbereich" & Chr(10) & "eintragen"
    ufmHauptarbeitsbereich.Show
End If

'Durch aktualisieren der Abmessungen kannn es dazu kommen, dass sich die Belastungen bei den Schweißnähten verändert haben, darum check ob alles in Ordnung ist
If ufmWellenzapfen.Label186.Caption <> "" Then
    If ufmWellenzapfen.TextBox11.Value < CDbl(ufmWellenzapfen.Label186.Caption) Then
        ufmWellenzapfen.TextBox11.BackColor = &HFF&
        Label1.BackColor = &HFF&
    Else
        ufmWellenzapfen.TextBox11.BackColor = "&H80000009"
    End If
End If

If ufmWellenzapfen.Label185.Caption <> "" Then
    If ufmWellenzapfen.TextBox12.Value < CDbl(ufmWellenzapfen.Label185.Caption) Then
        ufmWellenzapfen.TextBox12.BackColor = &HFF&
        Label1.BackColor = &HFF&
    Else
        ufmWellenzapfen.TextBox12.BackColor = "&H80000009"
    End If
End If

If ufmWellenzapfen.Label187.Caption <> "" Then
    If ufmWellenzapfen.TextBox13.Value < CDbl(ufmWellenzapfen.Label187.Caption) Then
        ufmWellenzapfen.TextBox13.BackColor = &HFF&
        Label1.BackColor = &HFF&
    Else
        ufmWellenzapfen.TextBox13.BackColor = "&H80000009"
    End If
End If

If ufmWellenzapfen.Label163.Caption <> "" And ufmWellenzapfen.Label158.Caption <> "" Then
```

```
      If ufmWellenzapfen.TextBox4.Value < CDbl(ufmWellenzapfen.Label163.Caption) Or ufm-
Wellenzapfen.TextBox4.Value < CDbl(ufmWellenzapfen.Label158.Caption) Then
         ufmWellenzapfen.TextBox4.BackColor = &HFF&
         Label1.BackColor = &HFF&
      Else
         ufmWellenzapfen.TextBox4.BackColor = "&H80000009"
      End If
   End If

   If ufmWellenzapfen.Label192.Caption <> "" Then
      If ufmWellenzapfen.TextBox2.Value > CDbl(ufmWellenzapfen.Label192.Caption) Then
         ufmWellenzapfen.TextBox2.BackColor = &HFF&
         Label1.BackColor = &HFF&
      Else
         ufmWellenzapfen.TextBox2.BackColor = "&H80000009"
      End If
   End If

End Sub

Private Sub Label1_Click()
   ufmAblenkwinkel.Hide

   'Aktualisierte minimale Schweißnahthöhen
   ufmWellenzapfen.Label173.Caption = CDbl(Worksheets("Berechnung").Cells(40, 6).Value)
   ufmWellenzapfen.Label163.Caption = Worksheets("Berechnung").Cells(44, 6).Value
   ufmWellenzapfen.Label196.Caption = Worksheets("Berechnung").Cells(38, 6).Value

   ufmWellenzapfen.Show
End Sub

Private Sub Label2_Click()

   ufmAblenkwinkel.Hide

   ufmSchweißnahtfreistich.Show
End Sub

Private Sub OptionButton1_Click()
   Label13.Caption = 0
```

```
    Worksheets("Berechnung").Cells(65, 6).Value = 0
    CommandButton2_Click
End Sub

Private Sub OptionButton2_Click()
    Worksheets("Berechnung").Cells(65, 6).Value = 1
    Label13.Caption = Worksheets("Berechnung").Cells(4, 2).Value
    CommandButton2_Click
End Sub

Private Sub TextBox10_Change()

    'Unbearbeitet Mittenlänge
    If TextBox10.Value <> "" Then
        TextBox10.BackColor = "&H80000009"
        Worksheets("Berechnung").Cells(42, 2).Value = TextBox10.Value
    Else
        TextBox10.BackColor = &HFF&
        Worksheets("Berechnung").Cells(42, 2).Value = 0
    End If

End Sub

Private Sub TextBox1_Change()

    'Unbearbeiteter Durchmesser
    If TextBox1.Value <> "" Then
        TextBox1.BackColor = "&H80000009"
        If CDbl(TextBox1.Value) <= CDbl(Worksheets("Berechnung").Cells(15, 2).Value) - CDbl(Worksheets("Berechnung").Cells(13, 2).Value) Then
            TextBox9.Value = 0
            TextBox9.Enabled = False
            TextBox10.Value = 0
            TextBox10.Enabled = False
            Worksheets("Berechnung").Cells(43, 2).Value = CDbl(Worksheets("Berechnung").Cells(15, 2).Value) - CDbl(Worksheets("Berechnung").Cells(13, 2).Value)
        Else

            TextBox9.Value = ""
```

```
            TextBox9.Enabled = True
            TextBox10.Value = ""
            TextBox10.Enabled = True
            Worksheets("Berechnung").Cells(43, 2).Value = TextBox1.Value
        End If
    Else
        TextBox9.Value = ""
        TextBox9.Enabled = True
        TextBox10.Value = ""
        TextBox10.Enabled = True

        TextBox1.BackColor = &HFF&
        Worksheets("Berechnung").Cells(43, 2).Value = CDbl(Worksheets("Berechnung").Cells(15,
2).Value) - CDbl(Worksheets("Berechnung").Cells(13, 2).Value)
    End If

End Sub

Private Sub TextBox2_Change()

    'Lagerabstand
    If TextBox2.Value <> "" Then
        TextBox2.BackColor = "&H80000009"
        Worksheets("Berechnung").Cells(20, 2).Value = TextBox2.Value
    Else
        TextBox2.BackColor = &HFF&
        Worksheets("Berechnung").Cells(20, 2).Value = 0
    End If

End Sub

Private Sub TextBox3_Exit(ByVal Cancel As MSForms.ReturnBoolean)

        'Trommelgesamtlänge
        'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
        Aktualisiere_TextBox3

End Sub

Private Sub TextBox4_Exit(ByVal Cancel As MSForms.ReturnBoolean)
```

```
'Mittenlänge gewählt
If TextBox4.Value <> "" Then

    Dim TB8 As Integer

    TextBox4.BackColor = "&H80000009"
    Worksheets("Berechnung").Cells(44, 2).Value = CDbl(TextBox4.Value)

    If TextBox4.Value <> TextB4 Then
        If TextBox8.BackColor <> &HFF& Then
            TextBox3.BackColor = "&H80000009"
            'TextBox3.Enabled = False
            TextBox3.Value = CDbl(Worksheets("Berechnung").Cells(57, 6).Value)
            TextB3 = TextBox3.Value
            TB8 = 1
        End If

        If TextBox3.BackColor <> &HFF& And TB8 <> 1 And TextBox8.Visible = True Then
            TextBox8.BackColor = "&H80000009"
            'TextBox8.Enabled = False
            TextBox8.Value = CDbl(Worksheets("Berechnung").Cells(58, 6).Value)
            TextB8 = TextBox8.Value
        End If
    End If

    If Worksheets("Tabelle1").Cells(2, 1).Value = "Doppelt" Then
        If Worksheets("Tabelle1").Cells(2, 3).Value = "außen" Then
            '-10mm für Übergangsradius auf beiden seiten - Seildurchmesser
            Label36.Caption = TextBox4.Value - "10" - Worksheets("Berechnung").Cells(13,
2).Value
        Else
            '-10mm für Übergangsradius und - 2* Klemmlänge auf beiden seiten
            Label36.Caption = TextBox4.Value - "10" - 2 * Worksheets("Berechnung").Cells(48,
6).Value
        End If
    Else
        If Worksheets("Tabelle1").Cells(2, 3).Value = "außen" Then
            '-5mm für Übergangsradius und - Schweißnahtfreistich - Seilrillensteigung + Seil-
durchmesser/2
```

```
        Label36.Caption = TextBox4.Value - "5" - Worksheets("Berechnung").Cells(32, 2).Value - Worksheets("Berechnung").Cells(20, 6).Value + Worksheets("Berechnung").Cells(13, 2).Value / 2
      Else
        '-5mm für Übergangsradius und - Schweißnahtfreistich - Klemmlänge
        Label36.Caption = TextBox4.Value - "5" - Worksheets("Berechnung").Cells(32, 2).Value - Worksheets("Berechnung").Cells(48, 6).Value
      End If
    End If

    TextB4 = TextBox4.Value
  Else
    TextBox4.BackColor = &HFF&
  End If

  If Label36.Caption < 0 Then
    Label36.Caption = 0
  End If




  'Berücksichtigt die 5mm Bearbeitungsradius
  'If TextBox10.Value = "" Or TextBox10.Value = 0 Then
  '   If Label36.Caption < 0 Then
  '       Label36.Caption = 0
  '       TextBox10.Value = 0
  '       TextBox10.Enabled = False
  '   Else
  '       TextBox10.Value = ""
  '       TextBox10.Enabled = True
  '   End If
  'End If

End Sub

'Private Sub TextBox5_Change()

  'Abstand Lagermitte-Unterflaschenmitte
  'If TextBox5.Value <> "" Then
    'TextBox5.BackColor = "&H80000009"
```

```
      'Worksheets("Berechnung").Cells(45, 2).Value = TextBox5.Value
   'Else
      'TextBox5.BackColor = &HFF&
      'Worksheets("Berechnung").Cells(45, 2).Value = 0
   'End If

'End Sub

Private Sub TextBox6_Change()

   'Unterflaschenbreite
   If TextBox6.Value <> "" Then
      TextBox6.BackColor = "&H80000009"
      Worksheets("Berechnung").Cells(40, 2).Value = TextBox6.Value
   Else
      TextBox6.BackColor = &HFF&
   End If

End Sub

Private Sub TextBox7_Change()

   'Mindestabstand von Umlenkrolle  zu Trommel
   If TextBox7.Value <> "" Then
      TextBox7.BackColor = "&H80000009"
      Worksheets("Berechnung").Cells(39, 2).Value = TextBox7.Value
   Else
      TextBox7.BackColor = &HFF&
   End If

End Sub

Private Sub TextBox8_Exit(ByVal Cancel As MSForms.ReturnBoolean)

   'Klemmlänge Kupplungsseitig
   'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen

   Dim TB4 As Integer
```

```
If TextBox8.Value <> "" Then

    TextBox8.BackColor = "&H80000009"
    Worksheets("Berechnung").Cells(33, 2).Value = CDbl(TextBox8.Value)



    If TextBox8.Value >= CDbl(Label33.Caption) Then
        If TextBox8.Value > TB8 Then
            If TB8 > CDbl(Label33.Caption) Then
                If Worksheets("Tabelle1").Cells(2, 1).Value = "Doppelt" Then
                    Label39.Caption = CDbl(Label39.Caption) + 2 * (TextBox8.Value - TB8)
                Else
                    Label39.Caption = CDbl(Label39.Caption) + TextBox8.Value - TB8
                End If
            Else
                If Worksheets("Tabelle1").Cells(2, 1).Value = "Doppelt" Then
                    Label39.Caption = CDbl(Label39.Caption) + 2 * (TextBox8.Value - CDbl(Label33.Caption))
                Else
                    Label39.Caption = CDbl(Label39.Caption) + TextBox8.Value - CDbl(Label33.Caption)
                End If
            End If
        Else
            If Worksheets("Tabelle1").Cells(2, 1).Value = "Doppelt" Then
                Label39.Caption = CDbl(Label39.Caption) + 2 * (TextBox8.Value - TB8)
            Else
                Label39.Caption = CDbl(Label39.Caption) + TextBox8.Value - TB8
            End If
        End If
        TB8 = TextBox8.Value
    Else
        If TB8 <> CDbl(Label33.Caption) Then
            If Worksheets("Tabelle1").Cells(2, 1).Value = "Doppelt" Then
                Label39.Caption = CDbl(Label39.Caption) + 2 * (CDbl(Label33.Caption) - TB8)
            Else
                Label39.Caption = CDbl(Label39.Caption) + CDbl(Label33.Caption) - TB8
            End If
            TB8 = CDbl(Label33.Caption)
        End If
```

```
        End If

        If TextBox8.Value <> TextB8 Then
            If TextBox4.BackColor <> &HFF& Then
                TextBox3.BackColor = "&H80000009"
                'TextBox3.Enabled = False
                TextBox3.Value = CDbl(Worksheets("Berechnung").Cells(57, 6).Value)
                TB4 = 1
                TextB3 = TextBox3.Value
            End If

            If TextBox3.BackColor <> &HFF& And TB4 <> 1 And TextBox4.Visible = True Then
                TextBox4.BackColor = "&H80000009"
                'TextBox4.Enabled = False
                TextBox4.Value = CDbl(Worksheets("Berechnung").Cells(56, 6).Value)
                TextB4 = TextBox4.Value
            End If
        End If

        TextB8 = TextBox8.Value

    Else
        TextBox8.BackColor = &HFF&
        'Label39.Caption = ""
    End If




End Sub

Private Sub TextBox9_Change()

    Dim Delta1 As Double
    Dim x As Double

    'Unbearbeitete Länge Kupplungsseitig
    If TextBox9.Value <> "" Then

        Delta1 = TextBox9.Value
```

```
'Miteinrechnen des Fertigungsradius allerdings nur beim ersten mal
If TextBox9.Value <> 0 Then
   If Delta2 = 0 Then
      x = Delta1 - Delta2 + 5
   Else
      x = Delta1 - Delta2
   End If
End If

TextBox9.BackColor = "&H80000009"
Worksheets("Berechnung").Cells(41, 2).Value = TextBox9.Value

If Worksheets("Tabelle1").Cells(2, 1).Value = "Einfach" Then
   Label39.Caption = CDbl(Label39.Caption) + x
Else
   Label39.Caption = CDbl(Label39.Caption) + 2 * x
End If

If TextBox9.Value <> 0 Then
   If Worksheets("Tabelle1").Cells(2, 3).Value = "außen" Then
      'Minimaler Abstand Bordscheibe = Schweißnahtfreistich + Klemmlänge + Unbearbeitete Länge Kupplungsseitig + 5mm Freistichradius
      Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value + Worksheets("Berechnung").Cells(48, 6).Value + TextBox9.Value + 5
   Else
      'Minimaler Abstand Bordscheibe = Schweißnahtfreistich + Unbearbeitete Länge Kupplungsseitig + 5mm Freistichradius + Seilrillensteigung - Seildurchmesser/2
      Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value + TextBox9.Value + 5 + Worksheets("Berechnung").Cells(20, 6).Value - Worksheets("Berechnung").Cells(13, 2).Value / 2
   End If
Else
   If Worksheets("Tabelle1").Cells(2, 3).Value = "außen" Then
      'Minimaler Abstand Bordscheibe = Schweißnahtfreistich + Klemmlänge
      Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value + Worksheets("Berechnung").Cells(48, 6).Value
   Else
      'Minimaler Abstand Bordscheibe = Schweißnahtfreistich + Seilrillensteigung - Seildurchmesser/2
      Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value + Worksheets("Berechnung").Cells(20, 6).Value - Worksheets("Berechnung").Cells(13, 2).Value / 2
   End If
```

```
        End If

        Delta2 = Delta1

    Else
        TextBox9.BackColor = &HFF&
        Worksheets("Berechnung").Cells(41, 2).Value = 0

        If Delta2 <> 0 Then
            If Worksheets("Tabelle1").Cells(2, 1).Value = "Einfach" Then
                Label39.Caption = CDbl(Label39.Caption) - Delta2 - 5
            Else
                Label39.Caption = CDbl(Label39.Caption) - 2 * (Delta2 + 5)
            End If

            Label33.Caption = CDbl(Label33.Caption) - Delta2 - 5
            Delta2 = 0
        End If

        'Minimaler Abstand Bordscheibe = Schweißnahtfreistich + Klemmlänge + Seilrillensteigung - Seildurchmesser/2
        'Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value + Worksheets("Berechnung").Cells(48, 6).Value + Worksheets("Berechnung").Cells(20, 6).Value - Worksheets("Berechnung").Cells(13, 2).Value / 2
    End If

End Sub

Public Sub Werte_kopieren()

    'CDbl wird verwendet bei Werten welche eine zu lange Kommastelle besitzen könnten

        If TextBox1.Value <> "" Then
            Worksheets("Berechnung").Cells(43, 2).Value = CDbl(TextBox1.Value)
        End If

        If TextBox2.Value <> "" Then
            Worksheets("Berechnung").Cells(20, 2).Value = CDbl(TextBox2.Value)
        End If
```

```
    If TextBox3.Value <> "" Then
      Worksheets("Berechnung").Cells(34, 2).Value = CDbl(TextBox3.Value)
    End If

    If TextBox4.Value <> "" Then
      Worksheets("Berechnung").Cells(44, 2).Value = CDbl(TextBox4.Value)
    End If

    If TextBox6.Value <> "" Then
      Worksheets("Berechnung").Cells(40, 2).Value = CDbl(TextBox6.Value)
    End If

    If TextBox7.Value <> "" Then
      Worksheets("Berechnung").Cells(39, 2).Value = CDbl(TextBox7.Value)
    End If

    If TextBox8.Value <> "" Then
      Worksheets("Berechnung").Cells(33, 2).Value = CDbl(TextBox8.Value)
    End If

    If TextBox9.Value <> "" Then
      Worksheets("Berechnung").Cells(41, 2).Value = CDbl(TextBox9.Value)
    End If

    If TextBox10.Value <> "" Then
      Worksheets("Berechnung").Cells(42, 2).Value = CDbl(TextBox10.Value)
    End If
End Sub

Public Sub Aktualisiere_TextBox3()

Dim TB8 As Integer

    If TextBox3.Value <> "" Then

      TextBox3.BackColor = "&H80000009"
      Worksheets("Berechnung").Cells(34, 2).Value = CDbl(TextBox3.Value)

      If TextBox3.Value <> TextB3 Then
```

```
            If TextBox8.BackColor <> &HFF& And TextBox4.Visible = True Then
              TextBox4.BackColor = "&H80000009"
              'TextBox4.Enabled = False

              TextBox4.Value = CDbl(Worksheets("Berechnung").Cells(56, 6).Value)

              Worksheets("Berechnung").Cells(44, 2).Value = CDbl(TextBox4.Value)

              TB8 = 1
              TextB4 = TextBox4.Value
            End If

            If TextBox4.BackColor <> &HFF& And TB8 <> 1 And TextBox8.Visible = True Then
              TextBox8.BackColor = "&H80000009"
              'TextBox8.Enabled = False

              TextBox8.Value = CDbl(Worksheets("Berechnung").Cells(58, 6).Value)

              TextB8 = TextBox8.Value
            End If
          End If
          TextB3 = CDbl(TextBox3.Value)
        Else
          TextBox3.BackColor = &HFF&
        End If

End Sub

Private Sub TextBox1_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox2_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
```

```
End Sub
Private Sub TextBox3_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox4_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox6_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox7_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox8_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox9_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox10_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
```

```
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox1_Enter()
    TextBox1.BackColor = &HFF00&
End Sub
Private Sub TextBox2_Enter()
    TextBox2.BackColor = &HFF00&
End Sub
Private Sub TextBox3_Enter()
    TextBox3.BackColor = &HFF00&
End Sub
Private Sub TextBox4_Enter()
    TextBox4.BackColor = &HFF00&
End Sub
Private Sub TextBox6_Enter()
    TextBox6.BackColor = &HFF00&
End Sub
Private Sub TextBox7_Enter()
    TextBox7.BackColor = &HFF00&
End Sub
Private Sub TextBox8_Enter()
    TextBox8.BackColor = &HFF00&
End Sub
Private Sub TextBox9_Enter()
    TextBox9.BackColor = &HFF00&
End Sub
Private Sub TextBox10_Enter()
    TextBox10.BackColor = &HFF00&
End Sub
```

8.2.1.3 ufmBeanspruchungsklasse

```
Private Sub CommandButton1_Click()
    Unload ufmBeanspruchungsklasse
End Sub
```

8.2.1.4 ufmBiegewechsel

```
Option Explicit
Public i As Integer
Public Berechnung_Pfad As String

Private Sub UserForm_Activate()
   i = 3
   Berechnung_Pfad = Application.ActiveWorkbook.Path
End Sub

Private Sub CommandButton1_Click()
   Unload ufmBiegewechsel
End Sub

Private Sub CommandButton2_Click()
   If i < 3 Then
      i = i + 1
      Set ufmBiegewechsel.Picture = LoadPicture(Berechnung_Pfad & "\" & "DIN 15020_Biegewechsel_Teil" & i & ".bmp")
   End If
End Sub

Private Sub CommandButton3_Click()
   If i > 1 Then
      i = i - 1
      Set ufmBiegewechsel.Picture = LoadPicture(Berechnung_Pfad & "\" & "DIN 15020_Biegewechsel_Teil" & i & ".bmp")
   End If
End Sub
```

8.2.1.5 ufmEinstufung

```
Private Sub CommandButton1_Click()
   Unload ufmEinstufung
End Sub
```

8.2.1.6 ufmHauptarbeitsbereich

```
'Zeichnen des Ablenkwinkels
Private Declare Function FindWindow Lib "user32" Alias _
   "FindWindowA" (ByVal lpClassName As String, _
```

```
    ByVal lpWindowName As String) As Long
Private Declare Function GetDC Lib "user32" _
    (ByVal hwnd As Long) As Long
Private Declare Function SetPixel Lib "gdi32" ( _
    ByVal hdc As Long, _
    ByVal x As Long, _
    ByVal Y As Long, _
    ByVal crColor As Long) As Long

Dim hwnd As Long, hdc As Long
Dim x1 As Single
Dim y1 As Single
Dim x2 As Single
Dim y2 As Single
Dim Check As Integer

Option Explicit

Private Sub CommandButton2_Click()
    Beanspruchungsklasse
    Schweißnähte
    Unload ufmHauptarbeitsbereich
End Sub

Private Sub CommandButton3_Click()

    Dim Wert As Double
    Dim i As Double
    Dim y1 As Double
    Dim y2 As Double

    Label14.Caption = Worksheets("Berechnung").Cells(61, 2).Value
    Label16.Caption = Worksheets("Berechnung").Cells(60, 2).Value
    Label14.Visible = True
    Label16.Visible = True

    y1 = Worksheets("Berechnung").Cells(61, 2).Value / Worksheets("Berechnung").Cells(4,
2).Value * 300 + 150

    'Verschieben der Label auf richtige Position
```

```
    Label14.Top = y1 / 4 * 3 - 12
    Label15.Top = y1 / 4 * 3 - 12
    Label15.Visible = True



    i = ((y1 - 150) / 300)
    Worksheets("Berechnung").Cells(64, 6).Value = i
    If Worksheets("Tabelle1").Cells(2, 3).Value = "außen" Then
        Wert = Worksheets("Berechnung").Cells(59, 6).Text
    Else
        Wert = Worksheets("Berechnung").Cells(61, 6).Text
    End If
    Label18.Caption = Wert
    Label18.Top = y1 / 4 * 3 - 12
    Label19.Top = y1 / 4 * 3 - 12
    Label18.Visible = True
    Label19.Visible = True

    'Rote Linie ziehen
    For i = 0 To 220 Step 0.05
        SetPixel hdc, i + 50 / 1, y1 / 1, vbBlue
    Next i

    y2 = Worksheets("Berechnung").Cells(60, 2).Value / Worksheets("Berechnung").Cells(4,
2).Value * 300 + 150

        'Verschieben der Label auf richtige Position
    Label16.Top = y2 / 4 * 3 - 12
    Label17.Top = y2 / 4 * 3 - 12
    Label17.Visible = True

    i = ((y2 - 150) / 300)
    Worksheets("Berechnung").Cells(64, 6).Value = i
    If Worksheets("Tabelle1").Cells(2, 3).Value = "außen" Then
        Wert = Worksheets("Berechnung").Cells(59, 6).Text
    Else
        Wert = Worksheets("Berechnung").Cells(61, 6).Text
    End If
    Label20.Caption = Wert
    Label20.Top = y2 / 4 * 3 - 12
```

```
    Label21.Top = y2 / 4 * 3 - 12
    Label20.Visible = True
    Label21.Visible = True

    'Rote Linie ziehen
    For i = 0 To 220 Step 0.05
        SetPixel hdc, i + 50 / 1, y2 / 1, vbBlue
    Next i

    Check = 1
    CommandButton1.Caption = "Refresh"

End Sub

Private Sub OptionButton1_Click()
    ufmAblenkwinkel.Label13.Caption = "fix"
    Worksheets("Hauptteil").Cells(758, 7).Value = "Mindestabstand fix:"
    Worksheets("Berechnung").Cells(65, 6).Value = 0
    CommandButton1.Enabled = True
    CommandButton1_Click
End Sub

Private Sub OptionButton2_Click()
    Worksheets("Berechnung").Cells(65, 6).Value = 1
    Worksheets("Hauptteil").Cells(758, 7).Value = "Mindestabstand var.:"
    ufmAblenkwinkel.Label13.Caption = Worksheets("Berechnung").Cells(4, 2).Value
    CommandButton1.Enabled = True
    CommandButton1_Click
End Sub

Private Sub UserForm_Activate()
    hwnd = FindWindow("ThunderDFrame", Me.Caption)
    hdc = GetDC(hwnd)
End Sub

Private Sub CommandButton1_Click()

    Dim a As Double
    Dim Wert As Double
```

```
Dim B As Double
Dim scale_x As Double
Dim HABz1 As Double
Dim HABz2 As Double

Label14.Top = 366
Label15.Top = 366
Label16.Top = 366
Label17.Top = 366
Label14.Visible = False
Label15.Visible = False
Label16.Visible = False
Label17.Visible = False
Label53.Visible = True
Label12.Visible = True
Label13.Visible = True
Label10.Visible = True
Label11.Visible = True

'Hubfaktor auf 1 setzen
Worksheets("Berechnung").Cells(64, 6).Value = 1

If Worksheets("Berechnung").Cells(6, 2).Value = 1 Then
  'Falls außen geklemmt wird
  'Ablenkwinkel für bewegliche Unterflasche sonst Umlenkrolle mit fixem Abstand
  If OptionButton2 = True Then
    'Alpha1
    Label2.Caption = Worksheets("Berechnung").Cells(59, 6).Text
    'Alpha2
    Label1.Caption = Worksheets("Berechnung").Cells(60, 6).Text
  Else
    Worksheets("Berechnung").Cells(64, 6).Value = 0
    'Alpha1
    Label2.Caption = Worksheets("Berechnung").Cells(61, 6).Text
    'Alpha2
    Label1.Caption = Worksheets("Berechnung").Cells(60, 6).Text
  End If
Else
  'Falls innen geklemmt wird (Steigung der Seilrillen wird negativ)
```

```
    Worksheets("Berechnung").Cells(64, 6).Value = 0

    'Ablenkwinkel für bewegliche Unterflasche sonst Umlenkrolle mit fixem Abstand
    'Alpha1
    If OptionButton2 = True Then
        'Alpha1
        Label2.Caption = Worksheets("Berechnung").Cells(61, 6).Text
        'Alpha2
        Label1.Caption = Worksheets("Berechnung").Cells(62, 6).Text
    Else
        Worksheets("Berechnung").Cells(64, 6).Value = 0
        'Alpha1
        Label2.Caption = Worksheets("Berechnung").Cells(59, 6).Text
        'ALpha2
        Label1.Caption = Worksheets("Berechnung").Cells(62, 6).Text
    End If
End If

    'Skalieren der x-Achse
    If Abs(CDbl(Label1.Caption)) > Abs(CDbl(Label2.Caption)) Then
        scale_x = 100 / Abs(CDbl(Label1.Caption))
    Else
        scale_x = 100 / Abs(CDbl(Label2.Caption))
    End If

    'Löschen des Graphen
    For a = 0 To 330 Step 0.7
        For B = 0 To 320 Step 0.7
            SetPixel hdc, a / 1, 450 - B / 1, vbWhite
        Next B
    Next a

    'Koordinatensystem
    'Ablenkwinkel alpha (x)
    For a = 0 To 220 Step 0.7
        SetPixel hdc, a + 50 / 1, 450 / 1, vbBlack
    Next a
    'Hubhöhe h (y)
    For a = 0 To 320 Step 0.7
```

```
        SetPixel hdc, 160 / 1, 450 - a / 1, vbBlack
    Next a

    'Graph
    For a = 0 To 1.001 Step 0.001
        If Worksheets("Tabelle1").Cells(2, 3).Value = "außen" Then
            Worksheets("Berechnung").Cells(64, 6).Value = a
            Wert = Worksheets("Berechnung").Cells(59, 6).Value

            If Wert > 1 Or Wert < -1 Then
                SetPixel hdc, 160 + scale_x * Wert / 1, 150 + a * 300 / 1, &H80C0FF
            Else
                SetPixel hdc, 160 + scale_x * Wert / 1, 150 + a * 300 / 1, vbGreen
            End If

            If Wert > 2.5 Or Wert < -2.5 Then
                SetPixel hdc, 160 + scale_x * Wert / 1, 150 + a * 300 / 1, vbRed
            End If

        Else
            Worksheets("Berechnung").Cells(64, 6).Value = a
            Wert = Worksheets("Berechnung").Cells(61, 6).Value

            If Wert > 1 Or Wert < -1 Then
                SetPixel hdc, 160 + scale_x * Wert / 1, 150 + a * 300 / 1, &H80C0FF
            Else
                SetPixel hdc, 160 + scale_x * Wert / 1, 150 + a * 300 / 1, vbGreen
            End If

            If Wert > 2.5 Or Wert < -2.5 Then
                SetPixel hdc, 160 + scale_x * Wert / 1, 150 + a * 300 / 1, vbRed
            End If
        End If
    Next a

HABz1 = Worksheets("Berechnung").Cells(60, 2).Value
HABz2 = Worksheets("Berechnung").Cells(61, 2).Value

'Auslesen der Werte für Berechnungsdokumentation
```

```
For a = 0 To 1.001 Step 0.05
    If Worksheets("Tabelle1").Cells(2, 3).Value = "außen" Then
        Worksheets("Berechnung").Cells(64, 6).Value = a
        Wert = Worksheets("Berechnung").Cells(59, 6).Value
        Worksheets("Hauptteil").Cells(505 + 20 * a, 13).Value = Wert
        Worksheets("Hauptteil").Cells(505 + 20 * a, 12).Value = a * Worksheets("Berechnung").Cells(4, 2).Value

        'Werte auslesen für Seilberechnung nach CEN/TS
        If a * Worksheets("Berechnung").Cells(4, 2).Value >= HABz1 And a * Worksheets("Berechnung").Cells(4, 2).Value <= HABz2 Then
            Worksheets("Hauptteil").Cells(1425 + 20 * a, 13).Value = Wert
            Worksheets("Hauptteil").Cells(1425 + 20 * a, 12).Value = a * Worksheets("Berechnung").Cells(4, 2).Value
        End If
    Else
        Worksheets("Berechnung").Cells(64, 6).Value = a
        Wert = Worksheets("Berechnung").Cells(61, 6).Value
        Worksheets("Hauptteil").Cells(505 + 20 * a, 13).Value = Wert
        Worksheets("Hauptteil").Cells(505 + 20 * a, 12).Value = a * Worksheets("Berechnung").Cells(4, 2).Value

        'Werte auslesen für Seilberechnung nach CEN/TS
        If a * Worksheets("Berechnung").Cells(4, 2).Value >= HABz1 And a * Worksheets("Berechnung").Cells(4, 2).Value <= HABz2 Then
            Worksheets("Hauptteil").Cells(1425 + 20 * a, 13).Value = Wert
            Worksheets("Hauptteil").Cells(1425 + 20 * a, 12).Value = a * Worksheets("Berechnung").Cells(4, 2).Value
        End If
    End If
Next a

'Eintragen des Auf- und Ablaufwinkels in die Seilberechnung nach CEN/TS
ufmSeilberechnung.TextBox17.Value = Worksheets("Hauptteil").Cells(1447, 3).Value

Check = 0

If ufmSeilberechnung.TextBox11.Value <> "" And ufmSeilberechnung.TextBox12.Value <> "" Then
    CommandButton3.Enabled = True
End If
```

```
End Sub

Private Sub UserForm_MouseMove(ByVal Button As Integer, _
   ByVal Shift As Integer, ByVal x As Single, ByVal Y As Single)

   Dim i As Double
   Dim Wert As Double

   y1 = Y * 4 / 3
   x1 = x * 4 / 3

   If x1 > 10 And x1 < 310 Then
      If y1 > 149 And y1 < 451 Then
         Label10.Caption = CDbl(CInt(((y1 - 150) / 300) * CInt(Worksheets("Berechnung").Cells(4,
2).Text) * 10) / 10)
         Label10.Top = y1 / 4 * 3 + 1
         Label11.Top = y1 / 4 * 3 + 1
         i = ((y1 - 150) / 300)
         Worksheets("Berechnung").Cells(64, 6).Value = i
         If Worksheets("Tabelle1").Cells(2, 3).Value = "außen" Then
            Wert = Worksheets("Berechnung").Cells(59, 6).Text
         Else
            Wert = Worksheets("Berechnung").Cells(61, 6).Text
         End If
         Label12.Caption = Wert
      End If
   End If
End Sub

Private Sub UserForm_MouseDown(ByVal Button As Integer, ByVal Shift As Integer, ByVal x
As Single, ByVal Y As Single)

   Dim i As Double
   Dim Wert As Double

   If Check = 0 Then
      If Button = 1 Then
         y1 = Y * 4 / 3
         If y1 > 149 And y1 < 451 Then
               If Label14.Visible = False Then
```

```
            For i = 0 To 220 Step 0.05
                SetPixel hdc, i + 50 / 1, y1 / 1, vbBlue
            Next i
            Label14.Caption = CInt(((y1 - 150) / 300) * Worksheets("Berechnung").Cells(4,
2).Value * 1000) / 1000

            'z1 für Seilberechnung bzw. Schweißnahtberechnung
            Worksheets("Berechnung").Cells(60, 2).Value = CDbl(Label14.Caption)
            ufmSeilberechnung.TextBox11.Value = CDbl(Label14.Caption)
            ufmParametereingabe.TextBox25.Value = CDbl(Label14.Caption)

            Label14.Top = y1 / 4 * 3 - 12
            Label15.Top = y1 / 4 * 3 - 12
            Label14.Visible = True
            Label15.Visible = True
            i = ((y1 - 150) / 300)
            Worksheets("Berechnung").Cells(64, 6).Value = i
            If Worksheets("Tabelle1").Cells(2, 3).Value = "außen" Then
                Wert = Worksheets("Berechnung").Cells(59, 6).Text
            Else
                Wert = Worksheets("Berechnung").Cells(61, 6).Text
            End If
            Label18.Caption = Wert
            Label18.Top = y1 / 4 * 3 - 12
            Label19.Top = y1 / 4 * 3 - 12
            Label18.Visible = True
            Label19.Visible = True
        Else
            For i = 0 To 220 Step 0.05
                SetPixel hdc, i + 50 / 1, y1 / 1, vbBlue
            Next i
            Label16.Caption = CInt(((y1 - 150) / 300) * Worksheets("Berechnung").Cells(4,
2).Value * 1000) / 1000

            'z2 für Seilberechnung bzw. Schweißnahtberechnung
            Worksheets("Berechnung").Cells(61, 2).Value = CDbl(Label16.Caption)
            ufmSeilberechnung.TextBox12.Value = CDbl(Label16.Caption)
            ufmParametereingabe.TextBox24.Value = CDbl(Label16.Caption)

            Label16.Top = y1 / 4 * 3 - 12
```

```
            Label17.Top = y1 / 4 * 3 - 12
            Label16.Visible = True
            Label17.Visible = True
             i = ((y1 - 150) / 300)
            Worksheets("Berechnung").Cells(64, 6).Value = i
            If Worksheets("Tabelle1").Cells(2, 3).Value = "außen" Then
              Wert = Worksheets("Berechnung").Cells(59, 6).Text
            Else
              Wert = Worksheets("Berechnung").Cells(61, 6).Text
            End If
            Label20.Caption = Wert
            Label20.Top = y1 / 4 * 3 - 12
            Label21.Top = y1 / 4 * 3 - 12
            Label20.Visible = True
            Label21.Visible = True
            CommandButton1.Caption = "Refresh"
            Check = 1
          End If
      'Worksheets("Tabelle1").Cells(2, 2).Value = x1
      End If
    End If
  End If

End Sub
```

8.2.1.7 ufmKlemmfaktor

```
Private Sub CommandButton1_Click()
  Unload ufmKlemmfaktor
End Sub

Private Sub TextBox1_Change()
  'B
  'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
  If TextBox1.Value <> "" Then
    ufmParametereingabe.TextBox23.Value = TextBox1.Value
  Else
    ufmParametereingabe.TextBox23.Value = 1
  End If
End Sub
```

```
Private Sub TextBox2_Change()
   'A
   'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
   If TextBox2.Value <> "" Then
      ufmParametereingabe.TextBox22.Value = TextBox2.Value
   Else
      ufmParametereingabe.TextBox22.Value = 1
   End If
End Sub

Private Sub TextBox1_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
   Case 44 To 57
   Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox2_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
   Case 44 To 57
   Case Else: KeyAscii = 0
  End Select
End Sub
```

8.2.1.8 ufmParametereingabe

```
Option Explicit

Private Sub ComboBox1_Change()

   'Triebwerksgruppe

   Dim Triebwerksgruppe As String
   Dim i As Integer
   Dim j As Integer

   Triebwerksgruppe = ComboBox1.Text

   Worksheets("Hauptteil").Cells(215, 6).Value = ComboBox1.Text
   Worksheets("Hauptteil").Cells(86, 8).Value = ComboBox1.Text
```

```
  For i = 1 To Worksheets("Triebwerksgruppen").Cells(65536, 1).End(xlUp).Row

    'Falls die ausgewählte Triebwerksgruppe dem Eintrag entspricht werden die Parameter übertragen

    If Worksheets("Triebwerksgruppen").Cells(i, 1).Text = Triebwerksgruppe Then

      'Beiwert h1 für Seiltrommel
      Worksheets("Berechnung").Cells(2, 6).Value = Worksheets("Triebwerksgruppen").Cells(i, 5).Value

      'Beiwert h1 für Seilrolle
      Worksheets("Berechnung").Cells(3, 6).Value = Worksheets("Triebwerksgruppen").Cells(i, 7).Value

      'Beiwert h1 für Ausgleichsrolle
      Worksheets("Berechnung").Cells(4, 6).Value = Worksheets("Triebwerksgruppen").Cells(i, 8).Value

      'Kupplungsfaktor Cerf
      Worksheets("Berechnung").Cells(6, 6).Value = Worksheets("Triebwerksgruppen").Cells(i, 6).Value

      'c Faktor für Seilberechnung
      If OptionButton1.Value = True Then
        'Seil mit 1770N/mm^2
        Worksheets("Berechnung").Cells(5, 6).Value = Worksheets("Triebwerksgruppen").Cells(i, 3).Value
      Else
        'Seil mit 1960N/mm^2
        Worksheets("Berechnung").Cells(5, 6).Value = Worksheets("Triebwerksgruppen").Cells(i, 4).Value
      End If
      Label38.Caption = Worksheets("Berechnung").Cells(5, 6).Value
    End If

  Next i

  Seildurchmesser

End Sub
```

```
Private Sub ComboBox2_Change()

    Worksheets("Hauptteil").Cells(92, 6).Value = ComboBox2.Value
    If TextBox2.Value <> "" Then
        Einstufung_psi
        'Trommelspannung aktualisieren
        If TextBox13.Value <> "" And TextBox14.Value <> "" Then
            TextBox14_Change
            TextBox13_Change
        End If
    Else
        MsgBox "Bitte Hubgeschwindigkeit eintragen"
    End If

End Sub

Private Sub ComboBox3_Change()

    'Kupplungswahl

    'Dim D_Trommel As Double
    'Dim D_Kupplung As Double
    Dim i As Integer
    Dim j As Integer
    Dim Auswahl As Double

    Auswahl = ComboBox3.Value

    'Schleife bis zum letzten Eintrag
    For i = 1 To Worksheets("Malmediekupplungen").Cells(65536, 1).End(xlUp).Row

        'Falls die ausgewählte Kupplung dem Eintrag entspricht werden die Parameter übertragen

        If Worksheets("Malmediekupplungen").Cells(i, 1).Text = Auswahl Then
            For j = 1 To 19

                'Kopieren vom Blatt "Malmediekupplungen" nach "Tabelle1"
                Worksheets("Tabelle1").Cells(2, j + 5).Value = Work-
sheets("Malmediekupplungen").Cells(i, j).Value
```

```
Next j

For j = 1 To 4

    'Kopieren vom Blatt "Malmediekupplungen" nach "Tabelle1"
    Worksheets("Tabelle1").Cells(2, j + 28).Value = Worksheets("Malmediekupplungen").Cells(i, j + 25).Value

Next j

For j = 1 To 4

    'Kopieren der Kupplungsschrauben
    Worksheets("Tabelle1").Cells(2, j + 102).Value = Worksheets("Malmediekupplungen").Cells(i, j + 29).Value

Next j

'Kopieren von Tkmax, Frmax und minimalem Bordscheibenschulterdurchmessers in die Berechnung, gegeben durch die Kupplung
Worksheets("Berechnung").Cells(12, 6).Value = Worksheets("Tabelle1").Cells(2, 23).Value
Worksheets("Berechnung").Cells(13, 6).Value = Worksheets("Malmediekupplungen").Cells(i, 20).Value
Worksheets("Berechnung").Cells(14, 6).Value = Worksheets("Malmediekupplungen").Cells(i, 21).Value

'Normbezeichnung in die Form eintragen
Label78.Caption = Worksheets("Malmediekupplungen").Cells(i, 24).Value

'Wellendurchmesser in die Form eintragen
Label83.Caption = Worksheets("Malmediekupplungen").Cells(i, 22).Value
Label85.Caption = Worksheets("Malmediekupplungen").Cells(i, 23).Value

'Aktualisieren der zul. Passfederlänge
Label90.Caption = Worksheets("Berechnung").Cells(26, 6).Value

'Wert d2 für Berechnung der Passfeder
Worksheets("Berechnung").Cells(92, 6).Value = Worksheets("Malmediekupplungen").Cells(i, 14).Value
```

```
        'Bohrungslänge der Kupplung für Passfederaufnahme
        Worksheets("Berechnung").Cells(26, 6).Value = Worksheets("Malmediekupplungen").Cells(i, 2).Value

        'Bordscheibendicke (bei Schraube = a2-t4) in Form Wellenzapfen ausgeben
        Worksheets("Berechnung").Cells(35, 2).Value = Worksheets("Malmediekupplungen").Cells(i, 26).Value - Worksheets("Malmediekupplungen").Cells(i, 28).Value

        'Bordscheibengesamtdicke für Trommellängenberechnung = Bordscheibendicke - Schulterbreite
        Worksheets("Berechnung").Cells(49, 6).Value = Worksheets("Malmediekupplungen").Cells(i, 26).Value - ufmSchweißnahtfreistich.TextBox5.Value

        'Kupplungsaufmaß zu Bordscheibe
        Worksheets("Berechnung").Cells(63, 6).Value = Worksheets("Malmediekupplungen").Cells(i, 4).Value - Worksheets("Malmediekupplungen").Cells(i, 5).Value
      End If

    Next i

End Sub

Private Sub ComboBox4_Change()

    'Übertragen des gewählten Seildurchmessers in die Berechnung
    Worksheets("Berechnung").Cells(13, 2).Value = ComboBox4.Value

    Dim Seilgewicht As Double
    Dim Anzahl_Flaschenzüge As Double
    Dim Anzahl_wirks_Seilstränge As Double
    Dim Hubhöhe As Double
    Dim parallele_Seilstränge As Double
    Dim spez_Seilgewicht As Double
    Dim i As Integer
    Dim k As Integer

    'Werte aus Berechnung auslesen
    Hubhöhe = Worksheets("Berechnung").Cells(4, 2)
    Anzahl_Flaschenzüge = Worksheets("Berechnung").Cells(9, 2)
```

```
Anzahl_wirks_Seilstränge = Worksheets("Berechnung").Cells(10, 2)
parallele_Seilstränge = Worksheets("Berechnung").Cells(12, 2)

'Schleife bis zum letzten Eintrag
For i = 1 To Worksheets("Seile").Cells(65536, 1).End(xlUp).Row

   'Falls das ausgewählte Seil dem Eintrag entspricht werden die Parameter übertragen

   If Worksheets("Seile").Cells(i, 1).Text = ComboBox4.Text Then

      'Kopieren der Mindestbruchkraft in die Berechnung für Seilberechnung nach CEN/TS 13001
      If OptionButton1.Value = True Then
         Worksheets("Berechnung").Cells(72, 6).Value = Worksheets("Seile").Cells(i, 3).Value
      Else
         Worksheets("Berechnung").Cells(72, 6).Value = Worksheets("Seile").Cells(i, 4).Value
      End If

      'Kopieren GesamtMetallQuerschnitt
      Worksheets("Berechnung").Cells(83, 6).Value = Worksheets("Seile").Cells(i, 5).Value

      spez_Seilgewicht = Worksheets("Seile").Cells(i, 2).Value
   End If

Next i

'Seildurchmesser in Übergabetabelle eintragen
Worksheets("Tabelle1").Cells(2, 33) = ComboBox4.Value

'Berechnung des Seilgewichtes für das gewählte Seil
Seilgewicht = spez_Seilgewicht * Hubhöhe * Anzahl_Flaschenzüge * Anzahl_wirks_Seilstränge * parallele_Seilstränge

'Übertragen des Gewichtes für gewählten Seildurchmessers in die Berechnung
Worksheets("Berechnung").Cells(14, 2).Value = Seilgewicht

'Übertragen des minimalen Seiltrommeldurchmessers (nach Seildurchmesser) in das Label
Label46.Caption = Worksheets("Berechnung").Cells(15, 10).Value

'Seilklemmenauswahl
```

```
Dim Seildurchmesser As Double

If ComboBox4.Value < 10 Or ComboBox4.Value > 42 Then
   MsgBox "Durchmesser unpassend für Seilklemmen"
Else
   For i = 1 To Worksheets("Seilklemmen").Cells(65536, 1).End(xlUp).Row - 1
      Seildurchmesser = Worksheets("Seilklemmen").Cells(1 + i, 1).Value
      If Seildurchmesser <= ComboBox4.Value Then

         Worksheets("Berechnung").Cells(19, 6).Value = Seildurchmesser

         'Schraubenvorspannkraft für Seilklemmen
         Worksheets("Berechnung").Cells(34, 6).Value = Worksheets("Seilklemmen").Cells(1 + i, 14).Value

         'e2 ,d7, b2, Schlüsselweite (SW), DIN74 T3 SB TB, h2, f2, Kopfhöhe und b3 um die/den minimale/n Klemmlänge/Bordscheibendurchmesser zu berechnen
         Worksheets("Berechnung").Cells(46, 6).Value = Worksheets("Seilklemmen").Cells(1 + i, 8).Value
         Worksheets("Berechnung").Cells(47, 6).Value = Worksheets("Seilklemmen").Cells(1 + i, 7).Value
         Worksheets("Berechnung").Cells(66, 6).Value = Worksheets("Seilklemmen").Cells(1 + i, 13).Value
         Worksheets("Berechnung").Cells(35, 6).Value = Worksheets("Seilklemmen").Cells(1 + i, 18).Value
         Worksheets("Berechnung").Cells(67, 6).Value = Worksheets("Seilklemmen").Cells(1 + i, 17).Value
         Worksheets("Berechnung").Cells(69, 6).Value = Worksheets("Seilklemmen").Cells(1 + i, 5).Value
         Worksheets("Berechnung").Cells(70, 6).Value = Worksheets("Seilklemmen").Cells(1 + i, 9).Value
         Worksheets("Berechnung").Cells(71, 6).Value = Worksheets("Seilklemmen").Cells(1 + i, 19).Value
         Worksheets("Berechnung").Cells(93, 6).Value = Worksheets("Seilklemmen").Cells(1 + i, 4).Value

         'Parameterübergabe (Tabelle1)
         For k = 1 To 12
            Worksheets("Tabelle1").Cells(2, 33 + k) = Worksheets("Seilklemmen").Cells(i + 1, 1 + k).Value
         Next k

            Worksheets("Tabelle1").Cells(2, 49) = Worksheets("Seilklemmen").Cells(i + 1, 15).Value
```

```
            Worksheets("Tabelle1").Cells(2, 108) = Worksheets("Seilklemmen").Cells(i + 1, 23).Value

          For k = 1 To 6
            Worksheets("Tabelle1").Cells(2, 49 + k) = Worksheets("Seilklemmen").Cells(i + 1, 16 + k).Value
          Next k




        End If
      Next i
    End If

    'Rillenauswahl
    If ComboBox4.Value < 6 Or ComboBox4.Value > 60 Then
      MsgBox "Durchmesser unpassend für Seilrillen"
    Else
      For i = 1 To Worksheets("Rillenabmessungen").Cells(65536, 1).End(xlUp).Row - 1
        Seildurchmesser = Worksheets("Rillenabmessungen").Cells(1 + i, 1).Value
        If Seildurchmesser = ComboBox4.Value Then
          'Seilrillensteigung = Rillensteigung für Seildurchmesser * Anzahl paralleler Seile
          Worksheets("Berechnung").Cells(20, 6).Value = Worksheets("Rillenabmessungen").Cells(1 + i, 2).Value * Worksheets("Berechnung").Cells(12, 2).Value

          'Seilrillenradius übergeben
          Worksheets("Berechnung").Cells(80, 6).Value = Worksheets("Rillenabmessungen").Cells(1 + i, 4).Value

           'Seilrillen a übergeben
          Worksheets("Berechnung").Cells(84, 6).Value = Worksheets("Rillenabmessungen").Cells(1 + i, 7).Value

          'Trommelspannung aktualisieren
          TextBox14_Change
          TextBox13_Change

          'Parameterübergabe (Tabelle1)

          For k = 1 To 5
```

```
                Worksheets("Tabelle1").Cells(2, 56 + k).Value = Worksheets("Rillenabmessungen").Cells(i + 1, 2 + k).Value
            Next k

        End If
    Next i
End If

'Bordscheibendurchmesser aktualisieren
If TextBox11.Value <> "" Then
    Label61.Caption = Worksheets("Berechnung").Cells(15, 6).Value
End If

'Klemmlänge in Form eintragen
ufmAblenkwinkel.Label17.Caption = Worksheets("Berechnung").Cells(48, 6).Value

'Durchmesserberechnug nach CEN/TS 13001 nun möglich
CommandButton2.Enabled = True

End Sub

Private Sub cmdAblenkwinkel_Click()

    Dim Berechnung_Pfad As String
    Dim Seiltrommelart As String
    Dim Seilklemmart As String
    Dim Seilzahl_pS As Double
    Dim Windungsrichtung As String
    Dim Seilklemmort As String
    Dim tmax As Double

    'Bilder müssen im gleichen Ordner wie die Berechnung (Exceldatei) sein
    Berechnung_Pfad = Application.ActiveWorkbook.Path
    'Einfach /Doppelt
    Seiltrommelart = Worksheets("Tabelle1").Cells(2, 1).Value
    'Bordscheibe/Trommel
    Seilklemmart = Worksheets("Tabelle1").Cells(2, 2).Value
    'innen/außen
    Seilklemmort = Worksheets("Tabelle1").Cells(2, 3).Value
```

```
'Laden der Unterschiedlichen Bilder je nach Seiltrommelart und Klemmung
Set ufmAblenkwinkel.Image1.Picture = LoadPicture(Berechnung_Pfad & "\" & Seiltrommelart & "_" & Seilklemmart & "_" & Seilklemmort & ".bmp")

'Beschriftung des Eingabefensters
ufmAblenkwinkel.Caption = Seiltrommelart & " " & Seilklemmart & " " & Seilklemmort

'Bearbeiteter Durchmesser
ufmAblenkwinkel.Label224.Caption = ">=" & CDbl(Worksheets("Berechnung").Cells(15, 2).Value) - CDbl(Worksheets("Berechnung").Cells(13, 2).Value)

'Bordscheibendicke für Einschraubtiefe
ufmWellenzapfen.Label133.Caption = Worksheets("Berechnung").Cells(35, 2).Value

'Seiltrommeldicke
ufmSchweißnahtfreistich.TextBox6.Value = TextBox14.Value

'Min. Schweißnahtdicke bei Schweißnahtfreistich
'ufmWellenzapfen.Label196 = Worksheets("Berechnung").Cells(38, 6).Value

'Min Schweißnahtdicke bei Wellenzapfen
'ufmWellenzapfen.Label173.Caption = Worksheets("Berechnung").Cells(40, 6).Value
'ufmWellenzapfen.Label163.Caption = Worksheets("Berechnung").Cells(44, 6).Value

'Min. Schweißnahtdicke Trommelmantel - Bordscheibe = wurzel(tmax)-0,5mm
If Worksheets("Berechnung").Cells(30, 2).Value > Worksheets("Berechnung").Cells(18, 2).Value Then
   tmax = Worksheets("Berechnung").Cells(30, 2).Value
Else
   tmax = Worksheets("Berechnung").Cells(18, 2).Value
End If

ufmSchweißnahtfreistich.Label166.Caption = tmax ^ 0.5 - 0.5

'Laden der berechneten Minimalabmessungen
ufmAblenkwinkel.Label11.Caption = Worksheets("Berechnung").Cells(25, 10).Value 'Ausgleichsrolle
ufmAblenkwinkel.Label15.Caption = Worksheets("Berechnung").Cells(45, 6).Value 'Wicklungslänge
ufmAblenkwinkel.Label17.Caption = Worksheets("Berechnung").Cells(48, 6).Value '-Klemmlänge (fix)
```

```
    ufmAblenkwinkel.Label19.Caption = Worksheets("Berechnung").Cells(49, 6).Value       'Bord-
scheibendicke Kupplungsseitig
    ufmAblenkwinkel.Label13.Caption = Worksheets("Berechnung").Cells(4, 2).Value        'Hub-
länge
    ufmAblenkwinkel.Label22.Caption = Worksheets("Berechnung").Cells(15, 2).Value       '-
Trommeldurchmesser
    ufmAblenkwinkel.Label24.Caption = Worksheets("Berechnung").Cells(17, 2).Value       'Bord-
scheibendurchmesser
    ufmAblenkwinkel.Label28.Caption = Worksheets("Berechnung").Cells(32, 2).Value       '-
Schweißnahtfreistich
    ufmAblenkwinkel.Label26.Caption = Worksheets("Berechnung").Cells(30, 2).Value -
Worksheets("Berechnung").Cells(36, 2).Value    'Bordscheibendicke Lagerseitig
    ufmAblenkwinkel.Label54.Caption = Worksheets("Berechnung").Cells(63, 6).Value       'Kupp-
lungsaufmaß

    'Mindestabstand Bordscheibe = Schweißnahtfreistich + Klemmlänge (fix)
    'If ufmAblenkwinkel.TextBox9.Value = "" Or ufmAblenkwinkel.TextBox9.Value = 0 Then
    '       ufmAblenkwinkel.Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value +
Worksheets("Berechnung").Cells(48, 6).Value
    'Else
    '       ufmAblenkwinkel.Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value +
Worksheets("Berechnung").Cells(48, 6).Value + ufmAblenkwinkel.TextBox9.Value + "5"
    'End If

    If Worksheets("Tabelle1").Cells(2, 1).Value = "Doppelt" Then
        'Doppelt

        'Minimale Gesamtlänge
        If Worksheets("Tabelle1").Cells(2, 3).Value = "außen" Then
            'Doppelt/außen
            'Mindestabstand links Bordscheibe
            If ufmAblenkwinkel.TextBox9.Value = "" Or ufmAblenkwinkel.TextBox9.Value = 0 Then
                ufmAblenkwinkel.Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value +
Worksheets("Berechnung").Cells(48, 6).Value
            Else
                ufmAblenkwinkel.Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value +
Worksheets("Berechnung").Cells(48, 6).Value + ufmAblenkwinkel.TextBox9.Value + "5"
            End If

            'Mindestmittenlänge = Seildurchmesser
            ufmAblenkwinkel.Label43.Caption = Worksheets("Berechnung").Cells(13, 2).Value

            If Worksheets("Tabelle1").Cells(2, 2).Value = "Bord" Then
```

```
            'Doppelt/außen/Bord
            'Klemmlänge gewählt = Klemmlänge für Bordscheibenklemmung
            Worksheets("Berechnung").Cells(33, 2).Value = Worksheets("Berechnung").Cells(48,
6).Value
            'Klemmlänge, linke Restlänge
            ufmAblenkwinkel.TextBox8.Value = Worksheets("Berechnung").Cells(48, 6).Value
            'Minmale Gesamtlänge = 2*(Klemmlänge+Wicklungslänge)+Bordscheibe Kupplungss.
+ Bordscheibe Wellenseitig-Bordscheibenschulter Wellenseitig + Seildurchmesser
            ufmAblenkwinkel.Label39.Caption = 2 * (Worksheets("Berechnung").Cells(48, 6).Value
+ Worksheets("Berechnung").Cells(45, 6).Value) + Worksheets("Berechnung").Cells(49, 6).Value
+ Worksheets("Berechnung").Cells(30, 2).Value - Worksheets("Berechnung").Cells(36, 2).Value +
Worksheets("Berechnung").Cells(13, 2).Value
          Else
            'Doppelt/außen/Trommel
            'Minmale Gesamtlänge = 2*(Klemmlänge+Wicklungslänge)+Bordscheibe Kupplungss.
+ Bordscheibe Wellenseitig + Bordscheibe Kupplungsseitig + Mittenabstand
            ufmAblenkwinkel.Label39.Caption = 2 * (CInt(ufmAblenkwinkel.Label33.Caption) +
CInt(ufmAblenkwinkel.Label15.Caption)) + CInt(ufmAblenkwinkel.Label43.Caption) +
CInt(ufmAblenkwinkel.Label19.Caption) + CInt(ufmAblenkwinkel.Label26.Caption)


          End If
        Else
          'Doppelt/innen
          'Mindestmittenlänge = 2 x Klemmlänge
          ufmAblenkwinkel.Label43.Caption = 2 * Worksheets("Berechnung").Cells(48, 6).Value


          'Mindestabstand links Bordscheibe
          If ufmAblenkwinkel.TextBox9.Value = "" Or ufmAblenkwinkel.TextBox9.Value = 0 Then
            ufmAblenkwinkel.Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value +
Worksheets("Berechnung").Cells(20, 6).Value - Worksheets("Berechnung").Cells(13, 2).Value / 2
          Else
            ufmAblenkwinkel.Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value +
ufmAblenkwinkel.TextBox9.Value + "5" + Worksheets("Berechnung").Cells(20, 6).Value - Work-
sheets("Berechnung").Cells(13, 2).Value / 2
          End If


          'Minmale Gesamtlänge = 2*(Klemmlänge+Wicklungslänge)+Bordscheibe Kupplungss. +
Bordscheibe Wellenseitig + Bordscheibe Kupplungsseitig + Mittenabstand
          ufmAblenkwinkel.Label39.Caption = 2 * (CInt(ufmAblenkwinkel.Label33.Caption) +
CInt(ufmAblenkwinkel.Label15.Caption)) + CInt(ufmAblenkwinkel.Label43.Caption) +
CInt(ufmAblenkwinkel.Label19.Caption) + CInt(ufmAblenkwinkel.Label26.Caption)


          'If Worksheets("Tabelle1").Cells(2, 2).Value = "Bord" Then
            'Doppelt/innen/Bord
```

```
        'Else
          'Doppelt/innen/Trommel
        'End If
      End If
    Else
      'Einfach

      If Worksheets("Tabelle1").Cells(2, 3).Value = "außen" Then
        'Einfach/außen
        'Mindestabstand links Bordscheibe

        If ufmAblenkwinkel.TextBox9.Value = "" Or ufmAblenkwinkel.TextBox9.Value = 0 Then
          ufmAblenkwinkel.Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value + Worksheets("Berechnung").Cells(48, 6).Value
        Else
          ufmAblenkwinkel.Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value + Worksheets("Berechnung").Cells(48, 6).Value + ufmAblenkwinkel.TextBox9.Value + "5"
        End If


        If Worksheets("Tabelle1").Cells(2, 2).Value = "Bord" Then
          'Einfach/außen/Bord
          'Klemmlänge gewählt = Klemmlänge für Bordscheibenklemmung
          Worksheets("Berechnung").Cells(33, 2).Value = Worksheets("Berechnung").Cells(48, 6).Value

          ufmAblenkwinkel.TextBox8.Value = Worksheets("Berechnung").Cells(48, 6).Value
          'Mindestabstand rechts = Schweißnahtfreistich + Seilrillensteigung - Seildurchmesser/2
          ufmAblenkwinkel.Label43.Caption = Worksheets("Berechnung").Cells(32, 2).Value + Worksheets("Berechnung").Cells(20, 6).Value - Worksheets("Berechnung").Cells(13, 2).Value / 2
          ufmAblenkwinkel.Label39.Caption = Worksheets("Berechnung").Cells(50, 6).Value
          'Linke Klemmlänge ausblenden
        Else
          'Einfach/außen/Trommel
          'Mindestmittenlänge = Schweißnahtfreistich + Seilrillensteigung - Seildurchmesser/2
          ufmAblenkwinkel.Label43.Caption = Worksheets("Berechnung").Cells(32, 2).Value + Worksheets("Berechnung").Cells(20, 6).Value - Worksheets("Berechnung").Cells(13, 2).Value / 2
          'Minmale Gesamtlänge = Klemmlänge + Wicklungslänge + Bordscheibe Kupplungss. + Bordscheibe Wellenseitig + Mittenabstand
```

```
            ufmAblenkwinkel.Label39.Caption = CInt(ufmAblenkwinkel.Label33.Caption) + CInt(ufmAblenkwinkel.Label15.Caption) + CInt(ufmAblenkwinkel.Label43.Caption) + CInt(ufmAblenkwinkel.Label19.Caption) + CInt(ufmAblenkwinkel.Label26.Caption)

         End If

      Else

         'Einfach/innen

         'Mindestabstand links Bordscheibe

         If ufmAblenkwinkel.TextBox9.Value = "" Or ufmAblenkwinkel.TextBox9.Value = 0 Then

            ufmAblenkwinkel.Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value + Worksheets("Berechnung").Cells(20, 6).Value - Worksheets("Berechnung").Cells(13, 2).Value / 2

         Else

            ufmAblenkwinkel.Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value + ufmAblenkwinkel.TextBox9.Value + "5" + Worksheets("Berechnung").Cells(20, 6).Value - Worksheets("Berechnung").Cells(13, 2).Value / 2

         End If



         If Worksheets("Tabelle1").Cells(2, 2).Value = "Bord" Then

            'Einfach/innen/Bord

            'Klemmlänge gewählt = Klemmlänge für Bordscheibenklemmung

            Worksheets("Berechnung").Cells(33, 2).Value = CDbl(ufmAblenkwinkel.Label33.Caption)

            Worksheets("Berechnung").Cells(44, 2).Value = Worksheets("Berechnung").Cells(48, 6).Value


            ufmAblenkwinkel.TextBox4.Value = Worksheets("Berechnung").Cells(48, 6).Value


            ufmAblenkwinkel.Label43.Caption = Worksheets("Berechnung").Cells(48, 6).Value

            ufmAblenkwinkel.Label39.Caption = Worksheets("Berechnung").Cells(57, 6).Value


         Else

            'Einfach/innen/Trommel

            ufmAblenkwinkel.Label43.Caption = Worksheets("Berechnung").Cells(48, 6).Value + Worksheets("Berechnung").Cells(32, 2).Value


            'Minmale Gesamtlänge = Klemmlänge + Wicklungslänge +Bordscheibe Kupplungss. + Bordscheibe Wellenseitig + Mittenabstand

            ufmAblenkwinkel.Label39.Caption = CInt(ufmAblenkwinkel.Label33.Caption) + CInt(ufmAblenkwinkel.Label15.Caption) + CInt(ufmAblenkwinkel.Label43.Caption) + CInt(ufmAblenkwinkel.Label19.Caption) + CInt(ufmAblenkwinkel.Label26.Caption)

         End If

      End If

   End If
```

```
    'Öffnen der Userform
    ufmParametereingabe.Hide
    Aktualisierung

End Sub

Private Sub ComboBox8_Change()
    Beanspruchungsklasse
    TextBox13_Change
    TextBox14_Change
    Worksheets("Hauptteil").Cells(102, 8).Value = ComboBox8.Value
    If ComboBox9.Text <> "" Then
        Spannungskollektiv
    End If
End Sub

Private Sub ComboBox9_Change()
    If ComboBox8.Text <> "" Then
        Worksheets("Hauptteil").Cells(104, 8).Value = ComboBox9.Value
        Spannungskollektiv
    End If
End Sub

Private Sub CommandButton10_Click()
    ufmSEBKupplung.Show
End Sub

Private Sub CommandButton11_Click()
    ufmBiegewechsel.Show
End Sub

Private Sub CommandButton12_Click()
    ufmSchraubenfaktor.Show
    ufmSchraubenfaktor.TextBox1.Value = TextBox26.Value
End Sub

Private Sub CommandButton2_Click()
    Seilberechnung_CEN13001_statisch
```

```
   ufmSeilberechnung.Show
End Sub

Private Sub CommandButton3_Click()
   ufmKlemmfaktor.Show
End Sub

Private Sub CommandButton4_Click()
   ufmTriebwerksgruppe.Show
End Sub

Private Sub CommandButton5_Click()
   ufmEinstufung.Show
End Sub

Private Sub CommandButton6_Click()
ufmzulWerte.TextBox1.Text = Worksheets("Berechnung").Cells(2, 13).Text
ufmzulWerte.TextBox2.Text = Worksheets("Berechnung").Cells(3, 14).Text
ufmzulWerte.TextBox3.Text = Worksheets("Berechnung").Cells(5, 14).Text
'ufmzulWerte.TextBox4.Text = Worksheets("Berechnung").Cells(3, 18).Text
'ufmzulWerte.TextBox5.Text = Worksheets("Berechnung").Cells(5, 19).Text
'ufmzulWerte.TextBox6.Text = Worksheets("Berechnung").Cells(6, 18).Text
'ufmzulWerte.TextBox7.Text = Worksheets("Berechnung").Cells(8, 18).Text
'ufmzulWerte.TextBox8.Text = Worksheets("Berechnung").Cells(10, 19).Text
'ufmzulWerte.TextBox9.Text = Worksheets("Berechnung").Cells(11, 18).Text
'ufmzulWerte.TextBox10.Text = Worksheets("Berechnung").Cells(14, 18).Text
'ufmzulWerte.TextBox11.Text = Worksheets("Berechnung").Cells(17, 18).Text

ufmzulWerte.Show
End Sub

Private Sub CommandButton7_Click()
   ufmBeanspruchungsklasse.Show
End Sub

Private Sub CommandButton8_Click()
   MsgBox "Gewichtung in Berechnung:" & Chr(10) & "0: 10% der Hübe mit Maximalgewicht" & Chr(10) & "1: 25% der Hübe mit Maximalgewicht" & Chr(10) & "2: 60% der Hübe mit Maximalgewicht" & Chr(10) & "3: 100% der Hübe mit Maximalgewicht", vbOKOnly, "Info"
End Sub
```

```
Private Sub CommandButton9_Click()
   ufmSeilstränge.Show
End Sub

Private Sub OptionButton1_Click()
   Worksheets("Berechnung").Cells(73, 6).Value = 1770
End Sub

Private Sub OptionButton2_Click()
   Worksheets("Berechnung").Cells(73, 6).Value = 1960
End Sub

Private Sub OptionButton3_Click()
   'Seiltrommeldurchmesser Eingabe
   Label71.Enabled = False
   Label70.Enabled = False
   TextBox16.Enabled = False
   Label15.Enabled = True
   Label49.Enabled = True
   TextBox11.Enabled = True
   TextBox16.BackColor = &HE0E0E0
   TextBox11.BackColor = &H80000005
End Sub

Private Sub OptionButton4_Click()
   'Windungszahl Eingabe
   Label71.Enabled = True
   Label70.Enabled = True
   TextBox16.Enabled = True
   Label15.Enabled = False
   Label49.Enabled = False
   TextBox11.Enabled = False
   TextBox16_Change
   TextBox11.BackColor = &HE0E0E0
   TextBox16.BackColor = &H80000005
End Sub

Private Sub OptionButton5_Click()
```

```
    If ComboBox8.Value <> "" Then
        Beanspruchungsklasse
        Worksheets("Berechnung").Cells(45, 2).Value = 2
    Else
        MsgBox "Beanspruchungsklasse ausfüllen"
    End If
End Sub

Private Sub OptionButton6_Click()
    If ComboBox8.Value <> "" Then
        Beanspruchungsklasse
        Worksheets("Berechnung").Cells(45, 2).Value = 1
        Worksheets("Berechnung").Cells(79, 2).Value = 1
    Else
        MsgBox "Beanspruchungsklasse ausfüllen"
    End If
End Sub

Private Sub OptionButton7_Click()
    If ComboBox8.Value <> "" Then
        Beanspruchungsklasse
        Worksheets("Berechnung").Cells(45, 2).Value = 1
        Worksheets("Berechnung").Cells(79, 2).Value = 2
    Else
        MsgBox "Beanspruchungsklasse ausfüllen"
    End If
End Sub

Private Sub Passfeder_1_Click()
    Worksheets("Berechnung").Cells(24, 6).Value = 1
    Label212.Caption = Worksheets("Berechnung").Cells(91, 6).Value
    Worksheets("Tabelle1").Cells(2, 27).Value = 1
    Worksheets("Tabelle1").Cells(2, 28).Value = 0
End Sub

Private Sub Passfeder_2_Click()
    Worksheets("Berechnung").Cells(24, 6).Value = 2
    Label212.Caption = Worksheets("Berechnung").Cells(91, 6).Value
    Worksheets("Tabelle1").Cells(2, 27).Value = 2
```

```
    Worksheets("Tabelle1").Cells(2, 28).Value = 240
End Sub

Private Sub Passfeder_3_Click()
    Worksheets("Berechnung").Cells(24, 6).Value = 2
    Label212.Caption = Worksheets("Berechnung").Cells(91, 6).Value
    Worksheets("Tabelle1").Cells(2, 27).Value = 2
    Worksheets("Tabelle1").Cells(2, 28).Value = 120
End Sub

Private Sub Passfeder_4_Click()
    Worksheets("Berechnung").Cells(24, 6).Value = 2
    Label212.Caption = Worksheets("Berechnung").Cells(91, 6).Value
    Worksheets("Tabelle1").Cells(2, 27).Value = 2
    Worksheets("Tabelle1").Cells(2, 28).Value = 180
End Sub

Private Sub TextBox1_Change()
    'Tragkraft Q
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox1.Value <> "" Then
        Worksheets("Berechnung").Cells(2, 2).Value = CDbl(TextBox1.Value)
    Else
        Worksheets("Berechnung").Cells(2, 2).Value = 0
    End If
    Seildurchmesser
End Sub

Private Sub TextBox10_Change()
    'Wirkungsgrad Seil auf Trommel
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox10.Value <> "" Then
        Worksheets("Berechnung").Cells(11, 2).Value = CDbl(TextBox10.Value)
    Else
        Worksheets("Berechnung").Cells(11, 2).Value = 0
    End If
End Sub

Private Sub TextBox11_Exit(ByVal Cancel As MSForms.ReturnBoolean)
```

```
'Seiltrommeldurchmesser
'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
If TextBox11.Value <> "" Then

    If OptionButton3.Value = True Then
        Worksheets("Berechnung").Cells(15, 2).Value = CDbl(TextBox11.Value)

        'Trommelspannung aktualisieren
        TextBox14_Change
        TextBox13_Change
    End If

    Label54.Caption = Worksheets("Berechnung").Cells(30, 10).Value
    Label56.Caption = Worksheets("Berechnung").Cells(32, 10).Value
    Label61.Caption = Worksheets("Berechnung").Cells(15, 6).Value
    'Ausgabe der Windungszahl in die TextBox
    TextBox16.Value = Worksheets("Berechnung").Cells(16, 6).Value
    Worksheets("Berechnung").Cells(21, 2).Value = TextBox16.Value

    If ComboBox4.Value <> "" Then
        If Worksheets("Berechnung").Cells(68, 6).Text <> "#DIV/0!" And Worksheets("Berechnung").Cells(68, 6).Text <> "#ZAHL!" Then
            Label197.Caption = Worksheets("Berechnung").Cells(68, 6).Value
        End If
    End If
    Beanspruchungsklasse
Else
    Worksheets("Berechnung").Cells(15, 2).Value = 600
End If

'erst wenn der wert höher als 100mm ist wird die Kupplung berechnet
'Werte die kleiner als 250mm sind sind sowieso nicht möglich, da der kleinste kupplungsdurchmesser 250mm ist
If Worksheets("Berechnung").Cells(15, 2).Value >= 250 Then
    Kupplungsberechnung
End If

'Bordscheibendurchmesser
'Meldung erst wenn ein Wert größer als 100mm eingegeben wird und die Durchmessereingabe kleiner ist als die Mindest
```

```
    If TextBox12.Value < Label61.Caption And TextBox12.TextLength > 2 And TextBox11.Value >= 250 Then
        MsgBox "Bordscheibendurchmesser zu klein gewählt"
    End If

    'Falls die Berechnung geändert wird, wird der Wert für die Seiltrommeldicke eingetragen
    If Worksheets("Berechnung").Cells(80, 2).Value = 2 Then
        TextBox14.Value = Worksheets("Berechnung").Cells(18, 2).Value
    End If

    Seilklemmkraft
    Seilklemmzahl

End Sub

Private Sub TextBox12_Exit(ByVal Cancel As MSForms.ReturnBoolean)
    'Bordscheibendurchmesser
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox12.Value <> "" Then
        Worksheets("Berechnung").Cells(17, 2).Value = TextBox12.Value
    Else
        Worksheets("Berechnung").Cells(17, 2).Value = 0
    End If

End Sub

Private Sub TextBox13_Change()
    'Minimale Seiltrommeldicke
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox13.Value <> "" And TextBox2.Value <> "" And ComboBox2.Value <> "" Then
        Worksheets("Berechnung").Cells(19, 2).Value = TextBox13.Value
        'zul. Spannung eintragen
        Label230.Caption = Worksheets("Berechnung").Cells(6, 18).Value
        Seiltrommeldicke_Solver

        'Trommelspannung aktualisieren
        TextBox14.Value = ""
        TextBox14_Change

        'Für Berechnung nach Scheffler
```

```
        interpolieren_phi_kappa
        interpolieren_phi_s
        interpolieren_phi_r

        'Bei Durchmesser Trommel zu Durchmesser Seil über 60 ist der Wert für die Trommeldicke nicht mehr gültig
        If Worksheets("Scheffler").Cells(3, 11).Value <= 60 Or Worksheets("Scheffler").Cells(3, 11).Value >= 15 Then
            Label199.ForeColor = &H80000012
            Label200.ForeColor = &H80000012
            Label201.ForeColor = &H80000012
        Else
            Label199.ForeColor = &HC0&
            Label200.ForeColor = &HC0&
            Label201.ForeColor = &HC0&
        End If

        'Ausgabe der minimalen Seiltrommeldicke Ernst
        Label201.Caption = Worksheets("Berechnung").Cells(86, 6).Value
    Else
        'Damit ein Wert zur Zeichnung übergeben wird welcher nicht auffällt
        'Worksheets("Berechnung").Cells(19, 2).Value = 0.1
    End If

    'Ausgabe der minimalen Seiltrommeldicke Scheffler
    Label92.Caption = Worksheets("Berechnung").Cells(28, 6).Value

End Sub

Private Sub TextBox14_Change()
    'Seiltrommeldicke gewählt
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox14.Value <> "" And TextBox2.Value <> "" And ComboBox2.Value <> "" Then
        Worksheets("Berechnung").Cells(18, 2).Value = CDbl(TextBox14.Value)
        Worksheets("Berechnung").Cells(28, 6).Value = CDbl(TextBox14.Value)

        'Spannungen ausgeben
        'Nur wenn nicht durch Null dividiert wird bzw. keine Werte fehlen
        If Worksheets("Berechnung").Cells(92, 10).Text <> "#DIV/0!" And Worksheets("Berechnung").Cells(92, 10).Text <> "#ZAHL!" Then
```

```
            Label97.Caption = Worksheets("Berechnung").Cells(29, 6).Value
            Label99.Caption = Worksheets("Berechnung").Cells(30, 6).Value
            Label102.Caption = Worksheets("Berechnung").Cells(31, 6).Value

            interpolieren_phi_r
            Label201.Caption = Worksheets("Berechnung").Cells(86, 6).Value
            Label215.Caption = Worksheets("Berechnung").Cells(117, 10).Value

            'Trommeldicke in ufmSchweißnahtfreistich ausgeben
            ufmSchweißnahtfreistich.TextBox6.Value = TextBox14.Value
        End If
    Else
        'Worksheets("Berechnung").Cells(18, 2).Value = 0
    End If
End Sub

Private Sub TextBox15_Change()
    'Minderungsfaktor für zul. Drehmoment zur Kupplungsberechnung

    Worksheets("Berechnung").Cells(23, 2).Value = 40

    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox15.TextLength >= 2 Then
        If TextBox15.Value <= 40 And TextBox15.Value >= 25 Then
            Worksheets("Berechnung").Cells(23, 2).Value = TextBox15.Value

            If TextBox11.Value <> "" Then
                Kupplungsberechnung
            End If
        Else
            MsgBox "Eingabewert ausserhalb der zulässigen Werte"
            Worksheets("Berechnung").Cells(23, 2).Value = 40
        End If
    End If

End Sub

Private Sub TextBox16_Change()
    'Windungen
```

```
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If OptionButton4.Value = True Then
        If TextBox16.Value <> "" Then
            Worksheets("Berechnung").Cells(21, 2).Value = TextBox16.Value
            Worksheets("Berechnung").Cells(15, 2).Value = Worksheets("Berechnung").Cells(17, 6).Value
            'Ausgabe des Seiltrommeldurchmessers in die TextBox
            TextBox11.Value = Worksheets("Berechnung").Cells(17, 6).Value
        Else
            Worksheets("Berechnung").Cells(21, 2).Value = 0
        End If
    End If
End Sub

Private Sub TextBox17_Change()
    'Reservewindungen
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox17.Value <> "" Then
        Worksheets("Berechnung").Cells(22, 2).Value = CDbl(TextBox17.Value)
    Else
        Worksheets("Berechnung").Cells(22, 2).Value = 0
    End If

    Seilklemmkraft
    Seilklemmzahl
End Sub

Private Sub TextBox18_Change()
    'Wellendurchmesser
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox18.Value <> "" Then
        Worksheets("Berechnung").Cells(24, 2).Value = TextBox18.Value
        Passfederwahl
        Label90.Caption = Worksheets("Berechnung").Cells(27, 6).Value

        If TextBox19.Value <> "" Then
            interpolieren_k1
        End If

        'Wert in Übergabetabelle eintragen
```

```
      Worksheets("Tabelle1").Cells(2, 17).Value = CDbl(TextBox18.Value)
   Else
      Worksheets("Berechnung").Cells(24, 2).Value = 1
   End If

End Sub

Private Sub TextBox19_Change()
   'Passfederlänge
   'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
   If TextBox19.Value <> "" Then
      Worksheets("Berechnung").Cells(25, 2).Value = TextBox19.Value
      'zul. Flächenpressung vergleichen mit Angaben und Passfederanzahl definieren
      Passfederwahl
      If TextBox18.Value <> "" And TextBox19.Value > 10 Then
         interpolieren_k1
      End If
   Else
      Worksheets("Berechnung").Cells(25, 2).Value = 1
   End If
End Sub

Private Sub TextBox2_Change()
   'Hubgeschwindigkeit
   'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
   If TextBox2.Value <> "" Then
      Worksheets("Berechnung").Cells(3, 2).Value = CDbl(TextBox2.Value)
      Einstufung_psi
   Else
      Worksheets("Berechnung").Cells(3, 2).Value = 0
   End If

End Sub

Private Sub TextBox20_Change()
   'Anzahl Seilklemmen
   'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
   If TextBox20.Value <> "" Then
      Worksheets("Berechnung").Cells(47, 2).Value = TextBox20.Value
```

```
        Seilklemmkraft
    Else
        Worksheets("Berechnung").Cells(47, 2).Value = 0
    End If
End Sub

Private Sub TextBox21_Change()
    'Winkelversatz Seilklemmen
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox21.Value <> "" Then
        Worksheets("Berechnung").Cells(48, 2).Value = CDbl(TextBox21.Value)
        Seilklemmkraft
        Seilklemmzahl
    Else
        Worksheets("Berechnung").Cells(48, 2).Value = 0
    End If
End Sub

Private Sub TextBox22_Change()
    'A
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox22.Value <> "" Then
        ufmKlemmfaktor.TextBox2.Value = TextBox22.Value
        Worksheets("Berechnung").Cells(77, 2).Value = TextBox22.Value
        Klemmfaktor
        Seilklemmkraft
        Label61.Caption = Worksheets("Berechnung").Cells(15, 6).Value
        Seilklemmzahl
    Else
        'Worksheets("Berechnung").Cells(4, 2).Value = 0
    End If
End Sub

Private Sub TextBox23_Change()
    'B
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox23.Value <> "" Then
        ufmKlemmfaktor.TextBox1.Value = TextBox23.Value
        Worksheets("Berechnung").Cells(78, 2).Value = TextBox23.Value
```

```
        Klemmfaktor
        Seilklemmkraft
        Label61.Caption = Worksheets("Berechnung").Cells(15, 6).Value
        Seilklemmzahl
    Else
        'Worksheets("Berechnung").Cells(4, 2).Value = 0
    End If
End Sub

Private Sub TextBox24_Change()

    'Eintragen des Hauptarbeitsbereiches(z2)

    If TextBox24.Value <> "" Then
        ufmSeilberechnung.TextBox12.Value = TextBox24.Value

        Worksheets("Berechnung").Cells(61, 2).Value = CDbl(TextBox24.Value)
    Else
        Worksheets("Berechnung").Cells(61, 2).Value = 0
    End If

    TextBox13_Change
    TextBox14_Change

End Sub

Private Sub TextBox25_Change()

    'Eintragen des Hauptarbeitsbereiches(z1)

    If TextBox25.Value <> "" Then
        ufmSeilberechnung.TextBox11.Value = TextBox25.Value

        Worksheets("Berechnung").Cells(60, 2).Value = CDbl(TextBox25.Value)
    Else
        Worksheets("Berechnung").Cells(60, 2).Value = 0
    End If

    TextBox13_Change
```

```
    TextBox14_Change

End Sub

Private Sub TextBox26_Change()
    If TextBox26.Value <> "" Then
        Worksheets("Berechnung").Cells(94, 6).Value = TextBox26.Value
        ufmSchraubenfaktor.TextBox1.Value = TextBox26.Value
    End If
End Sub

Private Sub TextBox3_Change()
    'Hubhöhe
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox3.Value <> "" Then
        Worksheets("Berechnung").Cells(4, 2).Value = CDbl(TextBox3.Value)
        ufmSeilberechnung.TextBox13.Value = TextBox3.Value
    Else
        Worksheets("Berechnung").Cells(4, 2).Value = 0
    End If
    Seildurchmesser
End Sub

Private Sub TextBox4_Change()
    'Anzahl der Biegewechsel
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox4.Value <> "" Then
        Worksheets("Berechnung").Cells(5, 2).Value = TextBox4.Value
    Else
        Worksheets("Berechnung").Cells(5, 2).Value = 0
    End If

    'Berechnung des Faktors h2 für die Seilrolle
    Dim h2 As Double

    h2 = 1
    If TextBox4.Value > 5 Then
        h2 = "1,12"
        If TextBox4.Value > 9 Then
```

```
            h2 = "1,25"
        End If
    End If

    'Überschreiben in Berechnung
    Worksheets("Berechnung").Cells(10, 6).Value = h2

    Seilklemmzahl

End Sub

Private Sub CommandButton1_Click()

    Dim i As Integer
    Dim k As Integer
    Dim ende As Double

    'OK
    If CommandButton1.Caption = "OK" Then

        Worksheets("Berechnung").Cells(82, 2).Value = 1

        'Formatierungsende
        If ufmSeilberechnung.Label34.Caption = "" Then
            ende = 1140
        ElseIf ufmSeilberechnung.Label79.Caption = "" Then
            ende = 1320
        Else
            ende = 1520
        End If

        If TextBox13.Value = "" Then
            'Damit ein Werte übergeben wird, welcher in der Zeichnung nicht auffällt
            Worksheets("Berechnung").Cells(19, 2).Value = 0.001
        End If


        'Grün und Rot einfärben der Ergebnisse
        For i = 2 To ende
```

```
    For k = 2 To 10
      If Worksheets("Hauptteil").Cells(i, k).Interior.ColorIndex = 4 Or Worksheets("Hauptteil").Cells(i, k).Interior.ColorIndex = 3 Then
        If Worksheets("Hauptteil").Cells(i, k + 1).Value >= Worksheets("Hauptteil").Cells(i, k - 3).Value Then
          Worksheets("Hauptteil").Cells(i, k).Interior.ColorIndex = 4
          Worksheets("Hauptteil").Cells(i, k + 1).Interior.ColorIndex = 4
          Worksheets("Hauptteil").Cells(i, k + 2).Interior.ColorIndex = 4
          Worksheets("Hauptteil").Cells(i, k - 1).Value = "<"
          k = k + 3
        Else
          Worksheets("Hauptteil").Cells(i, k).Interior.ColorIndex = 3
          Worksheets("Hauptteil").Cells(i, k + 1).Interior.ColorIndex = 3
          Worksheets("Hauptteil").Cells(i, k + 2).Interior.ColorIndex = 3
          Worksheets("Hauptteil").Cells(i, k - 1).Value = ">"
          k = k + 3
        End If
      End If
    Next k
  Next i

  'Gewählte Kupplung in Hauptteil eintragen
  Worksheets("Hauptteil").Cells(369, 6).Value = Label78.Caption

  Sheets("Hauptteil").Select

  'Falls Kehlnaht

  If Worksheets("Berechnung").Cells(73, 2).Value = 2 Then
    'Ring Rippe - Kehlnahtbild
    Worksheets("Hauptteil").Shapes("Picture 221").Select
    With ActiveWindow.Selection.ShapeRange(1)
      .Top = 12960
      .Left = 30
    End With
    'Ring Rippe - DHY_Nahtbild
    Worksheets("Hauptteil").Shapes("Picture 222").Select
    With ActiveWindow.Selection.ShapeRange(1)
      .Top = 12960
      .Left = 550
```

```
        End With
        'Ring Rippe - K_Nahtbild
        Worksheets("Hauptteil").Shapes("Picture 223").Select
        With ActiveWindow.Selection.ShapeRange(1)
            .Top = 12960
            .Left = 900
        End With
        'Wellenzapfen - Rippe - Kehlnahtbild
        Worksheets("Hauptteil").Shapes("Picture 220").Select
        With ActiveWindow.Selection.ShapeRange(1)
            .Top = 1430
            .Left = 30
        End With
        'Wellenzapfen - Rippe - DHY_Nahtbild
        Worksheets("Hauptteil").Shapes("Picture 219").Select
        With ActiveWindow.Selection.ShapeRange(1)
            .Top = 14340
            .Left = 520
        End With
        'Wellenzapfen - Rippe - K_Nahtbild
        Worksheets("Hauptteil").Shapes("Picture 218").Select
        With ActiveWindow.Selection.ShapeRange(1)
            .Top = 14340
            .Left = 900
        End With
    Else
        'Ring Rippe - Kehlnahtbild
        Worksheets("Hauptteil").Shapes("Picture 221").Select
        With ActiveWindow.Selection.ShapeRange(1)
            .Top = 12960
            .Left = 900
        End With
        'Wellenzapfen - Rippe - Kehlnahtbild
        Worksheets("Hauptteil").Shapes("Picture 220").Select
        With ActiveWindow.Selection.ShapeRange(1)
            .Top = 14340
            .Left = 900
        End With
```

```
If Worksheets("Berechnung").Cells(76, 2).Value * 2 < Worksheets("Berechnung").Cells(71, 2).Value Then
    'Ring Rippe - DHY_Nahtbild
    Worksheets("Hauptteil").Shapes("Picture 223").Select
    With ActiveWindow.Selection.ShapeRange(1)
        .Top = 12960
        .Left = 30
    End With
    'Ring Rippe - K_Nahtbild
    Worksheets("Hauptteil").Shapes("Picture 222").Select
    With ActiveWindow.Selection.ShapeRange(1)
        .Top = 12960
        .Left = 550
    End With
Else
    'Ring Rippe - DHY_Nahtbild
    Worksheets("Hauptteil").Shapes("Picture 223").Select
    With ActiveWindow.Selection.ShapeRange(1)
        .Top = 12960
        .Left = 550
    End With
    'Ring Rippe - K_Nahtbild
    Worksheets("Hauptteil").Shapes("Picture 222").Select
    With ActiveWindow.Selection.ShapeRange(1)
        .Top = 12960
        .Left = 30
    End With
End If

If Worksheets("Berechnung").Cells(74, 2).Value * 2 < Worksheets("Berechnung").Cells(71, 2).Value Then
    'Wellenzapfen - Rippe - DHY_Nahtbild
    Worksheets("Hauptteil").Shapes("Picture 219").Select
    With ActiveWindow.Selection.ShapeRange(1)
        .Top = 14340
        .Left = 30
    End With
    'Wellenzapfen - Rippe - K_Nahtbild
    Worksheets("Hauptteil").Shapes("Picture 218").Select
    With ActiveWindow.Selection.ShapeRange(1)
```

```
                .Top = 14340
                .Left = 550
            End With
        Else
            'Wellenzapfen - Rippe - DHY_Nahtbild
            Worksheets("Hauptteil").Shapes("Picture 219").Select
            With ActiveWindow.Selection.ShapeRange(1)
                .Top = 14340
                .Left = 550
            End With
            'Wellenzapfen - Rippe - K_Nahtbild
            Worksheets("Hauptteil").Shapes("Picture 218").Select
            With ActiveWindow.Selection.ShapeRange(1)
                .Top = 14340
                .Left = 30
            End With
        End If

    End If

    Range("D65:I66").Select

    Unload ufmAblenkwinkel
    Unload ufmWellenzapfen
    Unload ufmSchweißnahtfreistich
    Unload ufmSeilberechnung
    Unload ufmBeanspruchungsklasse
    Unload ufmEinstufung
    Unload ufmHauptarbeitsbereich
    Unload ufmKlemmfaktor
    Unload ufmTriebwerksgruppe
    Unload ufmzulWerte
    Unload ufmParametereingabe
Else
    'Abbrechen
    Worksheets("Berechnung").Cells(82, 2).Value = ""

    Unload ufmAblenkwinkel
    Unload ufmWellenzapfen
```

```
        Unload ufmSchweißnahtfreistich
        Unload ufmSeilberechnung
        Unload ufmBeanspruchungsklasse
        Unload ufmEinstufung
        Unload ufmHauptarbeitsbereich
        Unload ufmKlemmfaktor
        Unload ufmTriebwerksgruppe
        Unload ufmzulWerte
        Unload ufmParametereingabe
    End If

End Sub

Private Sub TextBox6_Change()
    'Traversengewicht
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox6.Value <> "" Then
        Worksheets("Berechnung").Cells(7, 2).Value = TextBox6.Value
    Else
        Worksheets("Berechnung").Cells(7, 2).Value = 0
    End If
    Seildurchmesser
End Sub

Private Sub TextBox7_Change()
    'Rollenwirkungsgrad
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox7.Value <> "" Then
        Worksheets("Berechnung").Cells(8, 2).Value = CDbl(TextBox7.Value)
    Else
        Worksheets("Berechnung").Cells(8, 2).Value = 0
    End If
    Seildurchmesser
End Sub

Private Sub TextBox8_Change()
    'Anzahl Flaschenzüge
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox8.Value <> "" Then
```

```
        Worksheets("Berechnung").Cells(9, 2).Value = TextBox8.Value
    Else
        Worksheets("Berechnung").Cells(9, 2).Value = 0
    End If
    Seildurchmesser
End Sub

Private Sub TextBox9_Change()

    'Anzahl wirksamer Seilstränge pro Flaschenzug
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox9.Value <> "" Then
        Worksheets("Berechnung").Cells(10, 2).Value = TextBox9.Value
    Else
        Worksheets("Berechnung").Cells(10, 2).Value = 0
    End If
    Seildurchmesser
End Sub

Private Sub TextBox1_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox2_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox3_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox4_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
```

```
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox6_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox7_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox8_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox9_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox10_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox11_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
```

```
End Sub
Private Sub TextBox12_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox13_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox14_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox15_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox16_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox17_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox18_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
```

```
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox19_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox20_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox21_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox22_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox23_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox24_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
```

```
End Sub
Private Sub TextBox25_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub ComboBox4_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub ComboBox3_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
```

8.2.1.9 ufmSchraubenfaktor

```
Option Explicit

Private Sub CommandButton1_Click()
  Unload ufmSchraubenfaktor
End Sub

Private Sub TextBox1_Exit(ByVal Cancel As MSForms.ReturnBoolean)

  If TextBox1.Value <> "" Then
    Worksheets("Berechnung").Cells(94, 6).Value = TextBox1.Value
    ufmParametereingabe.TextBox26.Value = TextBox1.Value
  End If

End Sub
```

8.2.1.10 ufmSchweißnahtfreistich

```
Option Explicit
```

```
Private Sub CommandButton1_Click()

    Dim TBNumber As Integer
    Dim i As Integer

    TBNumber = 6

    For i = 1 To TBNumber
        If Me.Controls("TextBox" & i).Value <> "" And Me.Controls("TextBox" & i).BackColor = &HFF00& Then
            Me.Controls("TextBox" & i).BackColor = &H80000009
        End If
    Next i

    'Falls nicht alle Werte in den Textboxen ausgefüllt sind, wird das Label "Detail B" rot angezeigt
    If TextBox1.BackColor = &HFF& Or TextBox2.BackColor = &HFF& Or TextBox3.BackColor = &HFF& Or TextBox4.BackColor = &HFF& Or TextBox5.BackColor = &HFF& Then
        ufmAblenkwinkel.Label2.BackColor = &HFF&
    Else
        ufmAblenkwinkel.Label2.BackColor = &H80000018
    End If

    ufmSchweißnahtfreistich.Hide
    'Aktualisierungsmaßnahme
    Aktualisierung
End Sub

Private Sub TextBox1_Change()
    'Trommelschulter Freistichhöhe
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox1.Value <> "" Then
        TextBox1.BackColor = "&H80000009"
        Worksheets("Berechnung").Cells(38, 2).Value = TextBox1.Value
    Else
        TextBox1.BackColor = &HFF&
        Worksheets("Berechnung").Cells(38, 2).Value = 0
    End If
```

```
    Restdicke_Seiltrommel
End Sub

Private Sub TextBox2_Change()
    'Trommelschulter Freistichlänge
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox2.Value <> "" Then
        TextBox2.BackColor = "&H80000009"
        Worksheets("Berechnung").Cells(37, 2).Value = TextBox2.Value
    Else
        TextBox2.BackColor = &HFF&
        Worksheets("Berechnung").Cells(37, 2).Value = 0
    End If
End Sub

Private Sub TextBox3_Change()
    'Schweißnahtfreistich Trommelstirnwand
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox3.Value <> "" Then
        TextBox3.BackColor = "&H80000009"
        Worksheets("Berechnung").Cells(32, 2).Value = TextBox3.Value
        ufmAblenkwinkel.Label28.Caption = TextBox3.Value
    Else
        TextBox3.BackColor = &HFF&
        Worksheets("Berechnung").Cells(32, 2).Value = 0
    End If

End Sub

Private Sub TextBox4_Exit(ByVal Cancel As MSForms.ReturnBoolean)
    'Schweißnaht Trommelstirnwand
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox4.Value <> "" Then
        TextBox4.BackColor = "&H80000009"
        Worksheets("Berechnung").Cells(27, 2).Value = CDbl(TextBox4.Value)
    Else
        TextBox4.BackColor = &HFF&
        Worksheets("Berechnung").Cells(27, 2).Value = 0
    End If
```

```
    Restdicke_Seiltrommel
End Sub

Private Sub TextBox5_Change()
    'Schweißnaht Schulterbreite
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox5.Value <> "" Then
        TextBox5.BackColor = "&H80000009"
        Worksheets("Berechnung").Cells(36, 2).Value = TextBox5.Value
    Else
        TextBox5.BackColor = &HFF&
        Worksheets("Berechnung").Cells(36, 2).Value = 0
    End If
End Sub

Private Sub TextBox6_Change()
    'Seiltrommeldicke gewählt
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox6.Value <> "" Then
        Worksheets("Berechnung").Cells(18, 2).Value = CDbl(TextBox6.Value)
        TextBox6.BackColor = "&H80000009"
        'Spannungen ausgeben
        'Nur wenn nicht durch Null dividiert wird bzw. keine Werte fehlen
        If Worksheets("Berechnung").Cells(92, 10).Text <> "#DIV/0!" And Work-
sheets("Berechnung").Cells(92, 10).Text <> "#ZAHL!" Then
            ufmParametereingabe.Label97.Caption = Worksheets("Berechnung").Cells(29, 6).Value
            ufmParametereingabe.Label99.Caption = Worksheets("Berechnung").Cells(30, 6).Value
            ufmParametereingabe.Label102.Caption = Worksheets("Berechnung").Cells(31, 6).Value

            'Trommeldicke in ufmParametereingabe ausgeben
            ufmParametereingabe.TextBox14.Value = TextBox6.Value
        End If
    Else
        TextBox6.BackColor = &HFF&
        'Worksheets("Berechnung").Cells(18, 2).Value = 0
    End If

    Restdicke_Seiltrommel
End Sub
```

```
Private Sub TextBox1_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox2_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox3_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox4_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox5_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox6_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox1_Enter()
  TextBox1.BackColor = &HFF00&
End Sub
```

```
Private Sub TextBox2_Enter()
    TextBox2.BackColor = &HFF00&
End Sub
Private Sub TextBox3_Enter()
    TextBox3.BackColor = &HFF00&
End Sub
Private Sub TextBox4_Enter()
    TextBox4.BackColor = &HFF00&
End Sub
Private Sub TextBox6_Enter()
    TextBox6.BackColor = &HFF00&
End Sub
```

8.2.1.11 ufmSEBKupplung

```
Private Sub CommandButton1_Click()
    Unload ufmSEBKupplung
End Sub
```

8.2.1.12 ufmSeilberechnung

```
Option Explicit

Public Hubwerkstyp As String
Public Lastkombination As String

Private Sub ComboBox1_Change()
    'Hubklasse der Hubeinrichtung
    Dim Hubklasse As String
    Dim i As Integer

    Hubklasse = ComboBox1.Text
    Worksheets("Hauptteil").Cells(1170, 5).Value = Hubklasse

    For i = 2 To Worksheets("CEN 13001").Cells(65536, 1).End(xlUp).Row

        'Falls die ausgewählte Hubklasse dem Eintrag entspricht werden die Parameter übertragen

        If Worksheets("CEN 13001").Cells(i, 1).Text = Hubklasse Then
            Worksheets("Berechnung").Cells(74, 6).Value = Worksheets("CEN 13001").Cells(i,
2).Value
```

```
        Worksheets("Berechnung").Cells(75, 6).Value = Worksheets("CEN 13001").Cells(i, 3).Value
      End If

    Next i

    Seilberechnung_CEN13001_statisch
End Sub

Private Sub ComboBox2_Change()
    'Hubwerkstyp und Betriebsart
    Dim i As Integer
    Dim a As Integer

    Hubwerkstyp = ComboBox2.Text
    Worksheets("Hauptteil").Cells(1174, 5).Value = Hubwerkstyp

    If ComboBox3.Text <> "" And TextBox1.Value <> "" Then
    '2D Matrix zur Bestimmung von vh
      For i = 3 To Worksheets("CEN 13001").Cells(65536, 6).End(xlUp).Row
        If Worksheets("CEN 13001").Cells(i, 6).Text = Hubwerkstyp Then
        For a = 7 To Worksheets("CEN 13001").Cells(2, 10).End(xlToLeft).Column
          If Worksheets("CEN 13001").Cells(2, a).Text = Lastkombination Then
            Worksheets("Berechnung").Cells(76, 6).Value = Worksheets("CEN 13001").Cells(i, a).Value
          End If
        Next a
        End If
      Next i
    End If

    Seilberechnung_CEN13001_statisch
End Sub

Private Sub ComboBox3_Change()
    'Lastkombination
    Dim i As Integer
    Dim a As Integer

    Lastkombination = ComboBox3.Text
```

```
    Worksheets("Hauptteil").Cells(1172, 5).Value = Lastkombination

    If ComboBox2.Text <> "" And TextBox1.Value <> "" Then
    '2D Matrix zur Bestimmung von vh
    For i = 3 To Worksheets("CEN 13001").Cells(65536, 6).End(xlUp).Row
        If Worksheets("CEN 13001").Cells(i, 6).Text = Hubwerkstyp Then
        For a = 7 To Worksheets("CEN 13001").Cells(2, 10).End(xlToLeft).Column
            If Worksheets("CEN 13001").Cells(2, a).Text = Lastkombination Then
                Worksheets("Berechnung").Cells(76, 6).Value = Worksheets("CEN 13001").Cells(i,
a).Value
            End If
        Next a
        End If
      Next i
    End If

    Seilberechnung_CEN13001_statisch
End Sub

Private Sub CommandButton1_Click()

    Sheets("Hauptteil").Select
    Range("B1219:D1221").Select
    Application.CutCopyMode = False
    Selection.ClearContents
    Selection.Interior.ColorIndex = xlNone

    'Dynamische oder Statische Prüflast (Formel kopieren)
    If OptionButton5.Value = True Then
      Worksheets("Hauptteil").Cells(1217, 3).Value = "dynamisch"
      Range("L1221:N1223").Select
      Selection.Copy
      Range("B1219").Select
      ActiveSheet.Paste
    Else
      Worksheets("Hauptteil").Cells(1217, 3).Value = "statisch"
      Range("L1219:N1219").Select
      Selection.Copy
      Range("B1219").Select
      ActiveSheet.Paste
```

```
    End If

    'Seilschmierung Ja oder Nein
    If OptionButton3.Value = True Then
        Worksheets("Hauptteil").Cells(1464, 4).Value = "JA"
    Else
        Worksheets("Hauptteil").Cells(1464, 4).Value = "NEIN"
    End If

    Range("B1224").Select
    Sheets("Berechnung").Select

    ufmSeilberechnung.Hide
End Sub

Private Sub CommandButton2_Click()
    ufmSeilberechnung.Hide
End Sub

Private Sub OptionButton1_Click()
    Worksheets("Berechnung").Cells(92, 18).Value = Worksheets("Berechnung").Cells(77,
18).Value
End Sub

Private Sub OptionButton2_Click()
    Worksheets("Berechnung").Cells(92, 18).Value = 1
End Sub

Private Sub OptionButton3_Click()
    Worksheets("Berechnung").Cells(104, 18).Value = 1
    TextBox18.Enabled = False
    Label68.Enabled = False
    Label69.Enabled = False
    Label70.Enabled = False
    Label71.Enabled = False
    TextBox18.Value = 1
End Sub

Private Sub OptionButton4_Click()
    TextBox18.Enabled = True
```

```
    Label68.Enabled = True
    Label69.Enabled = True
    Label70.Enabled = True
    Label71.Enabled = True
    TextBox18.Value = ""
End Sub

Private Sub OptionButton5_Click()
    TextBox21.Enabled = False
    Label83.Enabled = False
    Label84.Enabled = False
    Label85.Enabled = False
    Worksheets("Berechnung").Cells(59, 2).Value = ""
    TextBox21.Value = ""
End Sub

Private Sub OptionButton6_Click()
    TextBox21.Enabled = True
    Label83.Enabled = True
    Label84.Enabled = True
    Label85.Enabled = True
End Sub

Private Sub TextBox1_Change()
    'Feinhubgeschwindigkeit
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    Dim i As Integer
    Dim a As Integer

    If TextBox1.Value <> "" Then
        Worksheets("Berechnung").Cells(50, 2).Value = CDbl(TextBox1.Value)

    If ComboBox2.Text <> "" And ComboBox3.Text <> "" Then
    '2D Matrix zur Bestimmung von vh
        For i = 3 To Worksheets("CEN 13001").Cells(65536, 6).End(xlUp).Row
                If Worksheets("CEN 13001").Cells(i, 6).Text = Hubwerkstyp Then
                    For a = 7 To Worksheets("CEN 13001").Cells(2, 10).End(xlToLeft).Column
                        If Worksheets("CEN 13001").Cells(2, a).Text = Lastkombination Then
                            Worksheets("Berechnung").Cells(76, 6).Value = Worksheets("CEN 13001").Cells(i, a).Value
```

```
                End If
            Next a
        End If
    Next i
End If
Seilberechnung_CEN13001_statisch
Else
    Worksheets("Berechnung").Cells(50, 2).Value = 0
End If


End Sub

Private Sub TextBox11_Change() 'Exit(ByVal Cancel As MSForms.ReturnBoolean)
    'Arbeitsbereich von (z1)
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox11.Value <> "" Then

        ufmParametereingabe.TextBox25.Value = TextBox11.Value

        'zur Berechnung der zul. Spannung für Stirnnaht
        If ufmParametereingabe.ComboBox8.Text <> "" And TextBox12.Value <> "" Then
            Beanspruchungsklasse
        End If

        Worksheets("Berechnung").Cells(60, 2).Value = CDbl(TextBox11.Value)
        Seilberechnung_CEN13001_betriebsfest

    Else
        Worksheets("Berechnung").Cells(60, 2).Value = 0
    End If

End Sub

Private Sub TextBox12_Change() 'Exit(ByVal Cancel As MSForms.ReturnBoolean)
    'Arbeitsbereich bis (z2)
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox12.Value <> "" Then
```

```
    ufmParametereingabe.TextBox24.Value = TextBox12.Value

    'zur Berechnung der zul. Spannung für Stirnnaht
    If ufmParametereingabe.ComboBox8.Text <> "" And TextBox11.Value <> "" Then
      Beanspruchungsklasse
    End If

    Worksheets("Berechnung").Cells(61, 2).Value = CDbl(TextBox12.Value)
    Seilberechnung_CEN13001_betriebsfest
  Else
    Worksheets("Berechnung").Cells(61, 2).Value = 0
  End If

End Sub

Private Sub TextBox13_Change()
  'Referenzhöhe (zref)
  'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
  If TextBox13.Value <> "" Then
    Worksheets("Berechnung").Cells(62, 2).Value = CDbl(TextBox13.Value)
    Seilberechnung_CEN13001_betriebsfest
  Else
    Worksheets("Berechnung").Cells(62, 2).Value = 0
  End If

End Sub

Private Sub TextBox14_Change()
  'Winkel zw. Seil und wirkender Kraft (beta(z2))
  'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
  If TextBox14.Value <> "" Then
    Worksheets("Berechnung").Cells(63, 2).Value = CDbl(TextBox14.Value)
    Seilberechnung_CEN13001_betriebsfest
  Else
    Worksheets("Berechnung").Cells(63, 2).Value = 0
  End If

End Sub
```

```
Private Sub TextBox15_Change()
    'Seilkraftverlaufsparameter
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox15.Value <> "" And TextBox15.Value <> 0 Then
        Worksheets("Berechnung").Cells(64, 2).Value = CDbl(TextBox15.Value)
        Seilberechnung_CEN13001_betriebsfest
        betriebsfest_ff1
    Else
        Worksheets("Berechnung").Cells(64, 2).Value = 0
    End If

End Sub

Private Sub TextBox16_Change()
    'Kleinster relevanter Durchmesser
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox16.Value <> "" Then
        Worksheets("Berechnung").Cells(65, 2).Value = CDbl(TextBox16.Value)
        Seilberechnung_CEN13001_betriebsfest
        betriebsfest_ff1
    Else
        Worksheets("Berechnung").Cells(65, 2).Value = 0
    End If

End Sub

Private Sub TextBox17_Change()
    'Auf- und Ablaufwinkel
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox17.Value <> "" Then
        Worksheets("Berechnung").Cells(66, 2).Value = CDbl(TextBox17.Value)
        interpolieren_ff3
        Seilberechnung_CEN13001_betriebsfest
    Else
        Worksheets("Berechnung").Cells(66, 2).Value = 0
    End If

End Sub
```

```
Private Sub TextBox18_Change()
   'ff5
   'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
   If TextBox18.Value <> "" Then
      Worksheets("Berechnung").Cells(104, 18).Value = CDbl(TextBox18.Value)
      Seilberechnung_CEN13001_statisch
   Else
      Worksheets("Berechnung").Cells(104, 18).Value = 1
   End If

End Sub

Private Sub TextBox19_Change()
   'Seilartfaktor
   'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
   If TextBox19.Value <> "" Then
      Worksheets("Berechnung").Cells(67, 2).Value = CDbl(TextBox19.Value)
      interpolieren_ff6
      Seilberechnung_CEN13001_betriebsfest
   Else
      Worksheets("Berechnung").Cells(67, 2).Value = 0
   End If

End Sub

Private Sub TextBox2_Change()
   'Beschleunigung
   'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
   If TextBox2.Value <> "" Then
      Worksheets("Berechnung").Cells(51, 2).Value = CDbl(TextBox2.Value)
      Seilberechnung_CEN13001_statisch
   Else
      Worksheets("Berechnung").Cells(51, 2).Value = 0
   End If

End Sub

Private Sub TextBox21_Change()
   'phi6
```

```
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox21.Value <> "" Then
        Worksheets("Berechnung").Cells(59, 2).Value = CDbl(TextBox21.Value)
        Seilberechnung_CEN13001_statisch
    Else
        Worksheets("Berechnung").Cells(59, 2).Value = 0
    End If

End Sub

Private Sub TextBox3_Change()
    'phi5
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox3.Value <> "" Then
        Worksheets("Berechnung").Cells(52, 2).Value = CDbl(TextBox3.Value)
        Seilberechnung_CEN13001_statisch
    Else
        Worksheets("Berechnung").Cells(52, 2).Value = 0
    End If

End Sub

Private Sub TextBox4_Change()
    'beta max
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox4.Value <> "" Then
        Worksheets("Berechnung").Cells(53, 2).Value = CDbl(TextBox4.Value)
        Seilberechnung_CEN13001_statisch
    Else
        Worksheets("Berechnung").Cells(53, 2).Value = 0
    End If

End Sub

Private Sub TextBox5_Change()
    'auf die Hublast wirkende Horizontalkraft
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox5.Value <> "" Then
        'Falls die Kraft null ist, wird das Eingabefeld für den dazugehörigen Winkel deaktiviert
```

```
        If TextBox5.Value = 0 Then
            TextBox6.Enabled = False
            TextBox6.Value = 0
            Worksheets("Berechnung").Cells(55, 2).Value = 1
        Else
            TextBox6.Enabled = True
            TextBox6.Value = ""
            Worksheets("Berechnung").Cells(55, 2).Value = 1
        End If
        Worksheets("Berechnung").Cells(54, 2).Value = CDbl(TextBox5.Value)
        Seilberechnung_CEN13001_statisch
    Else
        Worksheets("Berechnung").Cells(54, 2).Value = 0
    End If

End Sub

Private Sub TextBox6_Change()
    'der Winkel zwischen Schwerkraft und projiziertem Seil in der aus Fh un g gebildeten Ebene
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox6.Value <> "" Then
        Worksheets("Berechnung").Cells(55, 2).Value = CDbl(TextBox6.Value)
        Seilberechnung_CEN13001_statisch
    Else
        Worksheets("Berechnung").Cells(55, 2).Value = 0
    End If

End Sub

Private Sub TextBox7_Change()
    'Teilsicherheitsbeiwert (gamma p)
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox7.Value <> "" Then
        Worksheets("Berechnung").Cells(56, 2).Value = CDbl(TextBox7.Value)
        Seilberechnung_CEN13001_statisch
    Else
        Worksheets("Berechnung").Cells(56, 2).Value = 0
    End If
```

```
End Sub

Private Sub TextBox8_Change()
    'Risikobeiwert (gamma n)
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox8.Value <> "" Then
        Worksheets("Berechnung").Cells(57, 2).Value = CDbl(TextBox8.Value)
        Seilberechnung_CEN13001_statisch
    Else
        Worksheets("Berechnung").Cells(57, 2).Value = 0
    End If

End Sub

Private Sub TextBox9_Change()
    'Kleinster relevanter Durchmesser
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox9.Value <> "" Then
        Worksheets("Berechnung").Cells(58, 2).Value = CDbl(TextBox9.Value)
        TextBox16.Value = TextBox9.Value
        Seilberechnung_CEN13001_statisch
    Else
        Worksheets("Berechnung").Cells(58, 2).Value = 0
    End If

End Sub

Private Sub TextBox1_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox2_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
```

```
Private Sub TextBox3_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox4_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox5_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox6_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox7_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox8_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox9_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
```

```
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox11_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox12_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox13_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox14_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox15_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox16_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
```

```
Private Sub TextBox17_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox18_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox19_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
Private Sub TextBox21_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
  Case 44 To 57
  Case Else: KeyAscii = 0
 End Select
End Sub
```

8.2.1.13 ufmSeilstränge

```
Private Sub CommandButton1_Click()
  Unload ufmSeilstränge
End Sub
```

8.2.1.14 ufmSeiltrommelart

```
Option Explicit
Public neuber As Integer

Private Sub CommandButton1_Click()


  Dim i As Integer
```

```
Dim d_zuvor As Double
Dim Berechnung_Pfad As String
Dim Seiltrommelart As String
Dim Seilklemmart As String
Dim Seilklemmort As String
Dim S As Shape

'Alle Werte aus der Berechung löschen
For i = 2 To 82
    Worksheets("Berechnung").Cells(i, 2).Value = ""
Next i

Worksheets("Berechnung").Cells(80, 2).Value = 1
'Einlesen der Comboboxen

'Triebwerksgruppe
For i = 4 To Worksheets("Triebwerksgruppen").Cells(65536, 1).End(xlUp).Row
    ufmParametereingabe.ComboBox1.AddItem Worksheets("Triebwerksgruppen").Cells(i, 1).Value
Next i

'Einstufung (psi)
For i = 3 To Worksheets("Einstufung B4004").Cells(65536, 1).End(xlUp).Row
    ufmParametereingabe.ComboBox2.AddItem Worksheets("Einstufung B4004").Cells(i, 1).Value
Next i

'Kupplungen
For i = 2 To Worksheets("Malmediekupplungen").Cells(65536, 1).End(xlUp).Row
    ufmParametereingabe.ComboBox3.AddItem Worksheets("Malmediekupplungen").Cells(i, 1).Value
Next i

'Seildurchmesser
For i = 2 To Worksheets("Seile").Cells(65536, 1).End(xlUp).Row
    ufmParametereingabe.ComboBox4.AddItem Worksheets("Seile").Cells(i, 1).Value
Next i

'Hubklasse der Hubeinrichtung
For i = 2 To Worksheets("CEN 13001").Cells(65536, 1).End(xlUp).Row
```

```
    ufmSeilberechnung.ComboBox1.AddItem Worksheets("CEN 13001").Cells(i, 1).Value
  Next i

  'Hubwerkstyp und Betriebsart
  For i = 3 To Worksheets("CEN 13001").Cells(65536, 6).End(xlUp).Row
    ufmSeilberechnung.ComboBox2.AddItem Worksheets("CEN 13001").Cells(i, 6).Value
  Next i

  'Lastkombination
  For i = 7 To Worksheets("CEN 13001").Cells(2, 10).End(xlToLeft).Column
    ufmSeilberechnung.ComboBox3.AddItem Worksheets("CEN 13001").Cells(2, i).Value
  Next i

  'Beanspruchungsklasse
  For i = 4 To Worksheets("zul. Spannungen").Cells(65536, 1).End(xlUp).Row
    ufmParametereingabe.ComboBox8.AddItem Worksheets("zul. Spannungen").Cells(i, 1).Value
  Next i

  'Spannungskollektiv
  For i = 4 To Worksheets("zul. Spannungen").Cells(65536, 18).End(xlUp).Row
    ufmParametereingabe.ComboBox9.AddItem Worksheets("zul. Spannungen").Cells(i, 18).Value
  Next i

  'Innendurchmesser des Lagers
  d_zuvor = 0
  For i = 2 To Worksheets("Pendelrollenlager").Cells(65536, 1).End(xlUp).Row
    'Jeder Innendurchmesser nur einmal
    If d_zuvor <> Worksheets("Pendelrollenlager").Cells(i, 1).Value Then
      ufmAblenkwinkel.ComboBox5.AddItem Worksheets("Pendelrollenlager").Cells(i, 1).Value
      d_zuvor = Worksheets("Pendelrollenlager").Cells(i, 1).Value
    End If
  Next i

  ufmParametereingabe.CommandButton2.Caption = "Seildurchmesser nach" & Chr(10) & "CEN/TS 13001"

  'Setzen der Startwerte
  'Anzahl paralleler Seile
```

```
Worksheets("Berechnung").Cells(12, 2).Value = 1
'Einfache(1) oder doppelte(2) Seiltrommel
Worksheets("Berechnung").Cells(16, 2).Value = 1
'Reservewindungen
Worksheets("Berechnung").Cells(22, 2).Value = 2
'Beiwert h2 für Seiltrommel
Worksheets("Berechnung").Cells(9, 6).Value = 1
'Beiwert h2 für SAusgleichsrolle
Worksheets("Berechnung").Cells(11, 6).Value = 1
'Seilfestigkeitsklasse
Worksheets("Berechnung").Cells(73, 6).Value = 1770
'phi6 CEN/TS 13001
Worksheets("Berechnung").Cells(59, 2).Value = ""
'fS3* CEN/TS 13001
Worksheets("Berechnung").Cells(92, 18).Value = 1
'ff5 CEN/TS 13001
Worksheets("Berechnung").Cells(104, 18).Value = 1
'Schweißnahtfreistich
Worksheets("Berechnung").Cells(32, 2).Value = 30
'Trommelschulter Freistichhöhe
Worksheets("Berechnung").Cells(38, 2).Value = 2
'Schweißnahtfeistich Trommelstirnwand Schulterbreite
Worksheets("Berechnung").Cells(36, 2).Value = 3
'Trommelschulter Freistichlänge
Worksheets("Berechnung").Cells(37, 2).Value = 10
'Kerbenradius
Worksheets("Berechnung").Cells(29, 2).Value = 30
'K-Naht bei Rippen
Worksheets("Berechnung").Cells(73, 2).Value = 1
'Anzahl Pendelrollenlager
Worksheets("Berechnung").Cells(55, 6).Value = 1
'Anzahl Seilklemmen
Worksheets("Berechnung").Cells(47, 2).Value = 3
'Wirkungsgrad Seil auf Trommel
Worksheets("Berechnung").Cells(11, 2).Value = 0.99
'Trommelmantel geschweißt
Worksheets("Berechnung").Cells(45, 2).Value = 1
'mit B-Linie
Worksheets("Berechnung").Cells(79, 2).Value = 1
```

```
'Faktor für normierte Schraubenvorspannkraft
Worksheets("Berechnung").Cells(94, 6).Value = 0.55

'Setzen der Startwerte in Übergabetabelle

'Passfederwerte
Worksheets("Tabelle1").Cells(2, 27).Value = 1
Worksheets("Tabelle1").Cells(2, 28).Value = 0

'If Einfache Seiltrommel = True
If OptionButton1.Value = True Then
    'Ausgabe in Berechnung und Tabelle1
    Worksheets("Tabelle1").Cells(2, 1).Value = "Einfach"
    Worksheets("Berechnung").Cells(16, 2).Value = "1"

    'Formel löschen aus Berechnung
    Sheets("Hauptteil").Select
    Range("K347").Select
    Selection.Copy
    Range("C346").Select
    ActiveSheet.Paste

    'Bild verschieben
    Worksheets("Hauptteil").Shapes("Picture 95").Select
    With ActiveWindow.Selection.ShapeRange(1)
        .Top = 4151
        .Left = 30
    End With

Else
    Worksheets("Tabelle1").Cells(2, 1).Value = "Doppelt"
    Worksheets("Berechnung").Cells(16, 2).Value = "2"

    'Formel löschen aus Berechnung
    Sheets("Hauptteil").Select
    Range("K346").Select
    Selection.Copy
    Range("C346").Select
    ActiveSheet.Paste
```

```
    'Bild verschieben
    Worksheets("Hauptteil").Shapes("Picture 95").Select
    With ActiveWindow.Selection.ShapeRange(1)
        .Top = 4151
        .Left = 600
    End With

End If

'Ablenkwinkel in Hauptarbeitsbereich löschen (in Berechnung)
Range("M1425:M1447").Select
Selection.Clear

'If Trommelklemmung = True
If OptionButton3.Value = True Then
    Worksheets("Hauptteil").Cells(820, 3).Value = "Seilklemmen bei Trommelklemmung (SEB 666211)"
    Worksheets("Hauptteil").Cells(42, 3).Value = "Seilklemmen bei Trommelklemmung (SEB 666211)"
    'Formel löschen aus Berechnung für Trommelklemmung
    Sheets("Hauptteil").Select
    Range("K540").Select
    Selection.Copy
    Range("C539").Select
    ActiveSheet.Paste
    Range("K556").Select
    Selection.Copy
    Range("B557").Select
    ActiveSheet.Paste

    'Bild verschieben
    Worksheets("Hauptteil").Shapes("Picture 91").Select
    With ActiveWindow.Selection.ShapeRange(1)
        .Top = 7125
        .Left = 600
    End With

    'Berechnung Seilklemmen
    Range("B827:J830").Select
```

```
Selection.ClearContents
Selection.Interior.ColorIndex = xlNone
Selection.Borders(xlDiagonalDown).LineStyle = xlNone
Selection.Borders(xlDiagonalUp).LineStyle = xlNone
Selection.Borders(xlEdgeLeft).LineStyle = xlNone
Selection.Borders(xlEdgeTop).LineStyle = xlNone
Selection.Borders(xlEdgeBottom).LineStyle = xlNone
Selection.Borders(xlEdgeRight).LineStyle = xlNone
Selection.Borders(xlInsideVertical).LineStyle = xlNone
Selection.Borders(xlInsideHorizontal).LineStyle = xlNone
Selection.UnMerge
Range("B845:J865").Select
Selection.ClearContents
Selection.Interior.ColorIndex = xlNone
Selection.Borders(xlDiagonalDown).LineStyle = xlNone
Selection.Borders(xlDiagonalUp).LineStyle = xlNone
Selection.Borders(xlEdgeLeft).LineStyle = xlNone
Selection.Borders(xlEdgeTop).LineStyle = xlNone
Selection.Borders(xlEdgeBottom).LineStyle = xlNone
Selection.Borders(xlEdgeRight).LineStyle = xlNone
Selection.Borders(xlInsideVertical).LineStyle = xlNone
Selection.Borders(xlInsideHorizontal).LineStyle = xlNone
Selection.UnMerge
Range("T827:Z830").Select
Selection.Copy
Range("B827").Select
ActiveSheet.Paste
Range("T845:Z863").Select
Application.CutCopyMode = False
Selection.Copy
Range("B845").Select
ActiveSheet.Paste
Worksheets("Hauptteil").Shapes("Picture 107").Select
With ActiveWindow.Selection.ShapeRange(1)
  .Top = 10995
  .Left = 600
End With

Sheets("Berechnung").Select
```

```
    Worksheets("Tabelle1").Cells(2, 2).Value = "Trommel"
    ufmParametereingabe.TextBox20.Enabled = False
    ufmParametereingabe.TextBox21.Enabled = False
    ufmParametereingabe.TextBox22.Enabled = False
    ufmParametereingabe.TextBox23.Enabled = False
    ufmParametereingabe.TextBox20.BackColor = &HE0E0E0
    ufmParametereingabe.TextBox21.BackColor = &HE0E0E0
    ufmParametereingabe.TextBox22.BackColor = &HE0E0E0
    ufmParametereingabe.TextBox23.BackColor = &HE0E0E0
    ufmParametereingabe.Label188.Enabled = False
    ufmParametereingabe.Label189.Enabled = False
    ufmParametereingabe.Label190.Enabled = False
    ufmParametereingabe.Label191.Enabled = False
    ufmParametereingabe.Label192.Enabled = False
    ufmParametereingabe.Label193.Enabled = False
    ufmParametereingabe.Label194.Enabled = False
    ufmParametereingabe.Label195.Enabled = False
    ufmParametereingabe.Label196.Enabled = False
    ufmParametereingabe.Label197.Enabled = False
    ufmParametereingabe.Label225.Enabled = False
    ufmParametereingabe.Label224.Enabled = False
    ufmParametereingabe.Label223.Enabled = False
    ufmParametereingabe.CommandButton3.Enabled = False
    Worksheets("Berechnung").Cells(47, 2).Value = 3
    Worksheets("Berechnung").Cells(49, 2).Value = 1
    Sheets("Hauptteil").Select

  Else
    Worksheets("Hauptteil").Cells(820, 3).Value = "Seilklemmen bei Bordscheibenklemmung"
    Worksheets("Hauptteil").Cells(42, 3).Value = "Seilklemmen bei Bordscheibenklemmung"
    'Formel löschen aus Berechnung für Bordscheibenklemmung
    Sheets("Hauptteil").Select
    Range("K539").Select
    Selection.Copy
    Range("C539").Select
    ActiveSheet.Paste
    Range("K557").Select
    Selection.Copy
    Range("B557").Select
```

```
ActiveSheet.Paste

'Bild verschieben
Worksheets("Hauptteil").Shapes("Picture 91").Select
With ActiveWindow.Selection.ShapeRange(1)
    .Top = 7125
    .Left = 30
End With

'Berechnung Seilklemme
Range("B827:J831").Select
Selection.ClearContents
Selection.Interior.ColorIndex = xlNone
Selection.Borders(xlDiagonalDown).LineStyle = xlNone
Selection.Borders(xlDiagonalUp).LineStyle = xlNone
Selection.Borders(xlEdgeLeft).LineStyle = xlNone
Selection.Borders(xlEdgeTop).LineStyle = xlNone
Selection.Borders(xlEdgeBottom).LineStyle = xlNone
Selection.Borders(xlEdgeRight).LineStyle = xlNone
Selection.Borders(xlInsideVertical).LineStyle = xlNone
Selection.Borders(xlInsideHorizontal).LineStyle = xlNone
Selection.UnMerge
Range("B844:J865").Select
Selection.ClearContents
Selection.Interior.ColorIndex = xlNone
Selection.Borders(xlDiagonalDown).LineStyle = xlNone
Selection.Borders(xlDiagonalUp).LineStyle = xlNone
Selection.Borders(xlEdgeLeft).LineStyle = xlNone
Selection.Borders(xlEdgeTop).LineStyle = xlNone
Selection.Borders(xlEdgeBottom).LineStyle = xlNone
Selection.Borders(xlEdgeRight).LineStyle = xlNone
Selection.Borders(xlInsideVertical).LineStyle = xlNone
Selection.Borders(xlInsideHorizontal).LineStyle = xlNone
Selection.UnMerge
Range("L828:S830").Select
Selection.Copy
Range("B828").Select
ActiveSheet.Paste
Range("L845:N856").Select
```

```
    Application.CutCopyMode = False
    Selection.Copy
    Range("B845").Select
    ActiveSheet.Paste
    Worksheets("Hauptteil").Shapes("Picture 107").Select
    With ActiveWindow.Selection.ShapeRange(1)
        .Top = 10995
        .Left = 200
    End With



    Worksheets("Tabelle1").Cells(2, 2).Value = "Bord"
    Worksheets("Berechnung").Cells(49, 2).Value = 2

End If

'If Seilklemmung außen = True
If OptionButton5.Value = True Then
    Worksheets("Tabelle1").Cells(2, 3).Value = "außen"
    Worksheets("Berechnung").Cells(6, 2).Value = "1"
Else
    Worksheets("Tabelle1").Cells(2, 3).Value = "innen"
    Worksheets("Berechnung").Cells(6, 2).Value = "2"
End If

'Anzahl paralleler Seilstränge
If TextBox1.Value <> "" Then
    Worksheets("Tabelle1").Cells(2, 4).Value = TextBox1.Value
    Worksheets("Berechnung").Cells(12, 2).Value = TextBox1.Value
Else
    Worksheets("Tabelle1").Cells(2, 4).Value = 1
    Worksheets("Berechnung").Cells(12, 2).Value = 1
End If

'voriges Bild der Seiltrommelart aus Bereich löschen
For Each S In ActiveSheet.Shapes
    If Not Intersect(Range("A475:J504"), S.TopLeftCell) Is Nothing Then
        S.Delete
    End If
```

```
    Next S

    'Bild der entsprechenden Seiltrommel in die Berechnung einfügen
    'Bilder müssen im gleichen Ordner wie die Berechnung (Exceldatei) sein
    Berechnung_Pfad = Application.ActiveWorkbook.Path
    'Einfach /Doppelt
    Seiltrommelart = Worksheets("Tabelle1").Cells(2, 1).Value
    'Bordscheibe/Trommel
    Seilklemmart = Worksheets("Tabelle1").Cells(2, 2).Value
    'innen/außen
    Seilklemmort = Worksheets("Tabelle1").Cells(2, 3).Value
    Range("B476").Select

    ActiveSheet.Pictures.Insert(Berechnung_Pfad & "\" & Seiltrommelart & "_" & Seilklemmart
& "_" & Seilklemmort & ".bmp").Select

    'Skalieren des Bildes
    Selection.ShapeRange.ScaleWidth 0.59, msoFalse, msoScaleFromTopLeft
    Selection.ShapeRange.ScaleHeight 0.59, msoFalse, msoScaleFromTopLeft
    Selection.ShapeRange.ScaleWidth 0.91, msoFalse, msoScaleFromTopLeft
    Selection.ShapeRange.ScaleHeight 0.91, msoFalse, msoScaleFromTopLeft
    Selection.ShapeRange.IncrementLeft 24#
    Sheets("Berechnung").Select

    'Erste Schätzwerte eintragen für minimale Seiltrommeldicke
    Worksheets("Berechnung").Cells(28, 6).Value = 10

    Unload ufmSeiltrommelart
    ufmParametereingabe.Show

End Sub

Private Sub CommandButton2_Click()

    Unload ufmSeiltrommelart

End Sub

Private Sub CommandButton3_Click()
```

```
    Dim i As Integer
    Dim d_zuvor As Double
    Dim da_min As Double
    Dim Lager As String

    'Es wird in die Berechnung eingetragen, ob die bestehende Berechnung verändert wurde
    Worksheets("Berechnung").Cells(80, 2).Value = 2

    ufmParametereingabe.CommandButton1.Caption = "OK"

'Beim ersten Klick wird die Art der Seiltrommel angezeigt, beim zweiten wird die Parameter-
form geladen
If neuber = 0 Then

    TextBox2.Text = Worksheets("Deckblatt").Cells(16, 1).Value

    If Worksheets("Tabelle1").Cells(2, 1) = "Doppelt" Then
        OptionButton2.Value = True
    Else
        OptionButton1.Value = True
    End If

    If Worksheets("Tabelle1").Cells(2, 2) = "Trommel" Then
        OptionButton3.Value = True
        ufmParametereingabe.TextBox20.Enabled = False
        ufmParametereingabe.TextBox21.Enabled = False
        ufmParametereingabe.TextBox22.Enabled = False
        ufmParametereingabe.TextBox23.Enabled = False
        ufmParametereingabe.TextBox20.BackColor = &HE0E0E0
        ufmParametereingabe.TextBox21.BackColor = &HE0E0E0
        ufmParametereingabe.TextBox22.BackColor = &HE0E0E0
        ufmParametereingabe.TextBox23.BackColor = &HE0E0E0
        ufmParametereingabe.Label188.Enabled = False
        ufmParametereingabe.Label189.Enabled = False
        ufmParametereingabe.Label190.Enabled = False
        ufmParametereingabe.Label191.Enabled = False
        ufmParametereingabe.Label192.Enabled = False
        ufmParametereingabe.Label193.Enabled = False
        ufmParametereingabe.Label194.Enabled = False
        ufmParametereingabe.Label195.Enabled = False
```

```
        ufmParametereingabe.Label196.Enabled = False
        ufmParametereingabe.Label197.Enabled = False
        ufmParametereingabe.Label225.Enabled = False
        ufmParametereingabe.Label224.Enabled = False
        ufmParametereingabe.Label223.Enabled = False
        ufmParametereingabe.CommandButton3.Enabled = False
    Else
        OptionButton4.Value = True
    End If

    If Worksheets("Tabelle1").Cells(2, 3) = "außen" Then
        OptionButton5.Value = True
    Else
        OptionButton6.Value = True
    End If

    TextBox1.Value = Worksheets("Tabelle1").Cells(2, 4).Value
    CommandButton1.Enabled = False
    CommandButton3.Caption = "OK"
    neuber = 1
Else

    'Einlesen der Felder
    ufmParametereingabe.TextBox1.Value = Worksheets("Berechnung").Cells(2, 2).Value
    ufmParametereingabe.TextBox2.Value = Worksheets("Berechnung").Cells(3, 2).Value
    ufmParametereingabe.TextBox3.Value = Worksheets("Berechnung").Cells(4, 2).Value

    If Worksheets("Berechnung").Cells(73, 6).Value = 1960 Then
        ufmParametereingabe.OptionButton2.Value = True
    Else
        ufmParametereingabe.OptionButton1.Value = True
    End If

    'Triebwerksgruppe
    For i = 4 To Worksheets("Triebwerksgruppen").Cells(65536, 1).End(xlUp).Row
        ufmParametereingabe.ComboBox1.AddItem Worksheets("Triebwerksgruppen").Cells(i,
1).Value
    Next i
    ufmParametereingabe.ComboBox1.Value = Worksheets("Hauptteil").Cells(86, 8).Value
```

```
'Einstufung (psi)
For i = 3 To Worksheets("Einstufung B4004").Cells(65536, 1).End(xlUp).Row
    ufmParametereingabe.ComboBox2.AddItem Worksheets("Einstufung B4004").Cells(i, 1).Value
Next i
ufmParametereingabe.ComboBox2.Value = Worksheets("Hauptteil").Cells(92, 6).Value

ufmParametereingabe.TextBox25.Value = Worksheets("Berechnung").Cells(60, 2).Value
ufmParametereingabe.TextBox24.Value = Worksheets("Berechnung").Cells(61, 2).Value

'Beanspruchungsklasse
For i = 4 To Worksheets("zul. Spannungen").Cells(65536, 1).End(xlUp).Row
    ufmParametereingabe.ComboBox8.AddItem Worksheets("zul. Spannungen").Cells(i, 1).Value
Next i
ufmParametereingabe.ComboBox8.Value = Worksheets("Hauptteil").Cells(102, 8).Value

'Spannungskollektiv
For i = 4 To Worksheets("zul. Spannungen").Cells(65536, 18).End(xlUp).Row
    ufmParametereingabe.ComboBox9.AddItem Worksheets("zul. Spannungen").Cells(i, 18).Value
Next i
ufmParametereingabe.ComboBox9.Value = Worksheets("Hauptteil").Cells(104, 8).Value

If Worksheets("Berechnung").Cells(45, 2).Value = 2 Then
    ufmParametereingabe.OptionButton5.Value = True
Else
    If Worksheets("Berechnung").Cells(79, 2).Value = 1 Then
        ufmParametereingabe.OptionButton6.Value = True
    Else
        ufmParametereingabe.OptionButton7.Value = True
    End If
End If

ufmParametereingabe.TextBox6.Value = Worksheets("Berechnung").Cells(7, 2).Value
ufmParametereingabe.TextBox4.Value = Worksheets("Berechnung").Cells(5, 2).Value
ufmParametereingabe.TextBox7.Value = Worksheets("Berechnung").Cells(8, 2).Value
ufmParametereingabe.TextBox8.Value = Worksheets("Berechnung").Cells(9, 2).Value
ufmParametereingabe.TextBox9.Value = Worksheets("Berechnung").Cells(10, 2).Value
ufmParametereingabe.TextBox10.Value = Worksheets("Berechnung").Cells(11, 2).Value
```

```
'Seildurchmesser
For i = 2 To Worksheets("Seile").Cells(65536, 1).End(xlUp).Row
    ufmParametereingabe.ComboBox4.AddItem Worksheets("Seile").Cells(i, 1).Value
Next i
ufmParametereingabe.ComboBox4.Value = Worksheets("Hauptteil").Cells(229, 7).Value

ufmParametereingabe.TextBox15.Value = Worksheets("Berechnung").Cells(23, 2).Value
ufmParametereingabe.TextBox26.Value = Worksheets("Berechnung").Cells(94, 6).Value
ufmParametereingabe.TextBox16.Value = Worksheets("Berechnung").Cells(21, 2).Value
ufmParametereingabe.TextBox11.Value = Worksheets("Berechnung").Cells(15, 2).Value
ufmParametereingabe.TextBox17.Value = Worksheets("Berechnung").Cells(22, 2).Value
ufmParametereingabe.TextBox21.Value = Worksheets("Berechnung").Cells(48, 2).Value
ufmParametereingabe.TextBox22.Value = Worksheets("Berechnung").Cells(77, 2).Value
ufmParametereingabe.TextBox23.Value = Worksheets("Berechnung").Cells(78, 2).Value
ufmParametereingabe.TextBox20.Value = Worksheets("Berechnung").Cells(47, 2).Value
ufmParametereingabe.TextBox12.Value = Worksheets("Berechnung").Cells(17, 2).Value

'Kupplungen
For i = 2 To Worksheets("Malmediekupplungen").Cells(65536, 1).End(xlUp).Row
    ufmParametereingabe.ComboBox3.AddItem Worksheets("Malmediekupplungen").Cells(i,
1).Value
Next i
ufmParametereingabe.ComboBox3.Value = Worksheets("Hauptteil").Cells(366, 6).Value

ufmParametereingabe.TextBox18.Value = Worksheets("Berechnung").Cells(24, 2).Value
ufmParametereingabe.TextBox19.Value = Worksheets("Berechnung").Cells(25, 2).Value

If Worksheets("Tabelle1").Cells(2, 27).Value = 2 Then
    If Worksheets("Tabelle1").Cells(2, 28).Value = 240 Then
        ufmParametereingabe.Passfeder_2.Value = True

    ElseIf Worksheets("Tabelle1").Cells(2, 28).Value = 120 Then
        ufmParametereingabe.Passfeder_3.Value = True

    Else
        ufmParametereingabe.Passfeder_4.Value = True
    End If
Else
    ufmParametereingabe.Passfeder_1.Value = True
```

```
End If

ufmParametereingabe.TextBox13.Value = Worksheets("Berechnung").Cells(19, 2).Value
ufmParametereingabe.TextBox14.Value = Worksheets("Berechnung").Cells(18, 2).Value

'Hubklasse der Hubeinrichtung
For i = 2 To Worksheets("CEN 13001").Cells(65536, 1).End(xlUp).Row
    ufmSeilberechnung.ComboBox1.AddItem Worksheets("CEN 13001").Cells(i, 1).Value
Next i

'Hubwerkstyp und Betriebsart
For i = 3 To Worksheets("CEN 13001").Cells(65536, 6).End(xlUp).Row
    ufmSeilberechnung.ComboBox2.AddItem Worksheets("CEN 13001").Cells(i, 6).Value
Next i

'Lastkombination
For i = 7 To Worksheets("CEN 13001").Cells(2, 10).End(xlToLeft).Column
    ufmSeilberechnung.ComboBox3.AddItem Worksheets("CEN 13001").Cells(2, i).Value
Next i

ufmParametereingabe.CommandButton2.Caption = "Seildurchmesser nach" & Chr(10) & "CEN/TS 13001"

'Wellenzapfen
ufmWellenzapfen.TextBox1.Value = Worksheets("Berechnung").Cells(31, 2).Value
ufmWellenzapfen.TextBox2.Value = Worksheets("Berechnung").Cells(68, 2).Value
ufmWellenzapfen.TextBox3.Value = Worksheets("Berechnung").Cells(69, 2).Value
ufmWellenzapfen.TextBox4.Value = Worksheets("Berechnung").Cells(28, 2).Value
ufmWellenzapfen.TextBox5.Value = Worksheets("Berechnung").Cells(29, 2).Value
ufmWellenzapfen.TextBox6.Value = Worksheets("Berechnung").Cells(30, 2).Value
ufmWellenzapfen.TextBox7.Value = Worksheets("Berechnung").Cells(26, 2).Value
ufmWellenzapfen.TextBox8.Value = Worksheets("Berechnung").Cells(70, 2).Value
ufmWellenzapfen.TextBox9.Value = Worksheets("Berechnung").Cells(71, 2).Value
ufmWellenzapfen.TextBox10.Value = Worksheets("Berechnung").Cells(72, 2).Value
ufmWellenzapfen.TextBox11.Value = Worksheets("Berechnung").Cells(74, 2).Value
ufmWellenzapfen.TextBox12.Value = Worksheets("Berechnung").Cells(75, 2).Value
ufmWellenzapfen.TextBox13.Value = Worksheets("Berechnung").Cells(76, 2).Value

'Schweißnahtfreistich
ufmSchweißnahtfreistich.TextBox1.Value = Worksheets("Berechnung").Cells(38, 2).Value
```

```
ufmSchweißnahtfreistich.TextBox2.Value = Worksheets("Berechnung").Cells(37, 2).Value
ufmSchweißnahtfreistich.TextBox3.Value = Worksheets("Berechnung").Cells(32, 2).Value
ufmSchweißnahtfreistich.TextBox4.Value = Worksheets("Berechnung").Cells(27, 2).Value
ufmSchweißnahtfreistich.TextBox5.Value = Worksheets("Berechnung").Cells(36, 2).Value
ufmSchweißnahtfreistich.TextBox6.Value = Worksheets("Berechnung").Cells(18, 2).Value

'Pendelrollenlager
'Innendurchmesser
d_zuvor = 0
For i = 2 To Worksheets("Pendelrollenlager").Cells(65536, 1).End(xlUp).Row
    'Jeder Innendurchmesser nur einmal
    If d_zuvor <> Worksheets("Pendelrollenlager").Cells(i, 1).Value Then
        ufmAblenkwinkel.ComboBox5.AddItem Worksheets("Pendelrollenlager").Cells(i, 1).Value
        d_zuvor = Worksheets("Pendelrollenlager").Cells(i, 1).Value
    End If
Next i
ufmAblenkwinkel.ComboBox5.Value = Worksheets("Berechnung").Cells(42, 6).Value

'Außendurchmesser
ufmAblenkwinkel.ComboBox6.Value = Worksheets("Berechnung").Cells(81, 2).Value

ufmAblenkwinkel.ComboBox6.BackColor = &H80000005
ufmAblenkwinkel.ComboBox7.BackColor = &HE0E0E0
ufmAblenkwinkel.ComboBox6.Enabled = True
ufmAblenkwinkel.ComboBox7.Enabled = False

ufmAblenkwinkel.Label221.Caption = Worksheets("Hauptteil").Cells(870, 4).Text

For i = 2 To Worksheets("Pendelrollenlager").Cells(65536, 1).End(xlUp).Row
    'Falls Bezeichnung gleich
    Lager = CStr(Worksheets("Pendelrollenlager").Cells(i, 7).Value)
    If ufmAblenkwinkel.Label221.Caption = Lager Then
        da_min = Worksheets("Pendelrollenlager").Cells(i, 8).Value
    End If
Next i

ufmWellenzapfen.Label158.Caption = da_min + 2 * CDbl(ufmWellenzapfen.TextBox5.Value)

'Breite
```

```
    ufmAblenkwinkel.ComboBox7.Value = Worksheets("Berechnung").Cells(43, 6).Value

    With ufmAblenkwinkel.ComboBox7
        .ColumnWidths = "30;30;30"
        .BackColor = &H80000005
        .Enabled = True
    End With

    ufmAblenkwinkel.Label221.Visible = True
    ufmAblenkwinkel.Label222.Visible = True

    'Schweißnahttextfelder sichtbar machen
    ufmWellenzapfen.TextBox11.Visible = True
    ufmWellenzapfen.TextBox12.Visible = True
    ufmWellenzapfen.TextBox13.Visible = True
    ufmWellenzapfen.Label185.Visible = True
    ufmWellenzapfen.Label186.Visible = True
    ufmWellenzapfen.Label187.Visible = True
    ufmWellenzapfen.Label188.Visible = True
    ufmWellenzapfen.Label189.Visible = True
    ufmWellenzapfen.Label190.Visible = True

    ufmParametereingabe.Show
    Unload ufmSeiltrommelart
End If

End Sub

Private Sub OptionButton1_Click()
    'Falls Einfachseiltrommel wird die Option für Innen oder Außen freigeschaltet
    Frame3.Visible = True
    OptionButton5.Caption = "Kupplungsseitig"
    OptionButton6.Caption = "Wellenseitig"
End Sub

Private Sub OptionButton2_Click()
    'Falls Bordscheibenklemmung und Doppelseiltrommel gewählt sind gibt es keine Auswahl für
innen oder außen
    If OptionButton4.Value = True Then
        Frame3.Visible = False
```

```
        OptionButton5.Value = True
    End If

    OptionButton5.Caption = "Außen"
    OptionButton6.Caption = "Innen"

End Sub

Private Sub OptionButton3_Click()
    'Falls Trommelklemmung wird die Option für Innen oder Außen freigeschaltet
    Frame3.Visible = True
End Sub

Private Sub OptionButton4_Click()
    'Falls Bordscheibenklemmung und Doppelseiltrommel gewählt sind gibt es keine Auswahl für
innen oder außen
    If OptionButton2.Value = True Then
        Frame3.Visible = False
        OptionButton5.Value = True
    End If
End Sub

Private Sub TextBox1_Change()

    'If mehrere parallele Seilstränge = True
    If TextBox1.Value > 1 Then

        Worksheets("Tabelle1").Cells(2, 2).Value = "Trommel"
        'Die Auswahl der Klemmart wird bei mehreren parallelen Seilsträngen auf Trommel ge-
sperrt
        Frame2.Visible = False
        'Trommelklemmung = True
        OptionButton3.Value = True

    Else
        'Klemmart wieder frei wählbar
        Frame2.Visible = True
    End If

End Sub
```

```
Private Sub TextBox1_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
 Select Case KeyAscii
   Case 44 To 57
   Case Else: KeyAscii = 0
 End Select
End Sub

Private Sub TextBox2_Exit(ByVal Cancel As MSForms.ReturnBoolean)
   Worksheets("Deckblatt").Cells(16, 1).Value = "Krannummer: " & TextBox2.Text
End Sub
```

8.2.1.15 ufmTriebwerksgruppe

```
Private Sub CommandButton1_Click()
  Unload ufmTriebwerksgruppe
End Sub
```

8.2.1.16 ufmWellenzapfen

```
Option Explicit
Public Check As Double

Private Sub CommandButton1_Click()

   Check = Check + 1

   Dim TBNumber As Long
   Dim Kontrolvariable As Integer
   Dim i As Long

   TBNumber = 13
   Kontrolvariable = 0

   'Falls eine TextBox grün ist und ein Wert vorhanden ist wird sie auf weiß gesetzt
   For i = 1 To TBNumber
      If Me.Controls("TextBox" & i).Value <> "" And Me.Controls("TextBox" & i).BackColor =
&HFF00& Then
         Me.Controls("TextBox" & i).BackColor = &H80000009
      End If
   Next i
```

```
    For i = 1 To TBNumber
        If Me.Controls("TextBox" & i).BackColor = &HFF& Then
            Kontrolvariable = Kontrolvariable + 1
        End If
    Next i

    'Falls nicht alle Werte in den Textboxen ausgefüllt sind, wird das Label "Detail A" rot ange-
zeigt
    If Kontrolvariable > 0 Then
        ufmAblenkwinkel.Label1.BackColor = &HFF&
    Else
        ufmAblenkwinkel.Label1.BackColor = &H80000018
    End If

    ufmWellenzapfen.Hide

    'Aktualisierungsmaßnahme
    Aktualisierung

End Sub

Private Sub CommandButton2_Click()
    Schweißnähte
    TextBox11_Change
    TextBox12_Change
    TextBox13_Change
    TextBox11.Visible = True
    TextBox12.Visible = True
    TextBox13.Visible = True
    Label185.Visible = True
    Label186.Visible = True
    Label187.Visible = True
    Label188.Visible = True
    Label189.Visible = True
    Label190.Visible = True
End Sub

Private Sub OptionButton1_Click()
```

```
    Dim Berechnung_Pfad As String

    'Bilder müssen im gleichen Ordner wie die Berechnung (Exceldatei) sein
    Berechnung_Pfad = Application.ActiveWorkbook.Path

    'Laden des Bildes mit K-Naht
    Set Image1.Picture = LoadPicture(Berechnung_Pfad & "\" & "Wellenzapfen_K_K.bmp")

    Worksheets("Berechnung").Cells(73, 2).Value = 1

    'K-Naht
    If ufmParametereingabe.ComboBox8.Value <> "" Then
        Beanspruchungsklasse
        'Schweißnähte Aktualisieren
        Schweißnähte
    End If

End Sub

Private Sub OptionButton2_Click()

    Dim Berechnung_Pfad As String

    'Bilder müssen im gleichen Ordner wie die Berechnung (Exceldatei) sein
    Berechnung_Pfad = Application.ActiveWorkbook.Path

    'Laden des Bildes mit Kehlnaht
    Set Image1.Picture = LoadPicture(Berechnung_Pfad & "\" & "Wellenzapfen_Ke_Ke.bmp")

    Worksheets("Berechnung").Cells(73, 2).Value = 2

    'Kehlnaht
    If ufmParametereingabe.ComboBox8.Value <> "" Then
        Beanspruchungsklasse
        'Schweißnähte Aktualisieren
        Schweißnähte
    End If

    'Check ob Schweißnähte zu klein
```

```
    CommandButton2_Click
End Sub

Private Sub TextBox1_Change()
    'Schweißnahtlänge Wellenzapfen
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox1.Value <> "" Then
        TextBox1.BackColor = "&H80000009"
        Worksheets("Berechnung").Cells(31, 2).Value = TextBox1.Value

        Label173.Caption = Worksheets("Berechnung").Cells(40, 6).Value
        Label163.Caption = Worksheets("Berechnung").Cells(44, 6).Value
    Else
        TextBox1.BackColor = &HFF&
        Worksheets("Berechnung").Cells(31, 2).Value = 0
    End If

End Sub

Private Sub TextBox10_Change()

    'Anzahl Rippen
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox10.Value <> "" Then
        TextBox10.BackColor = "&H80000009"
        Worksheets("Berechnung").Cells(72, 2).Value = TextBox10.Value
    Else
        TextBox10.BackColor = &HFF&
        Worksheets("Berechnung").Cells(72, 2).Value = 0
    End If

End Sub

Private Sub TextBox11_Change()

    'Schweißnahtdicke Wellenzapfen-Rippe
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox11.Value <> "" Then
        TextBox11.BackColor = "&H80000009"
```

```
        Worksheets("Berechnung").Cells(74, 2).Value = TextBox11.Value

        Schweißnähte

        'Falls die Schweißnähte zu groß sind für die Rippen
        If Label186.Caption <> "" Then
            If CDbl(TextBox11.Value * 2) > CDbl(TextBox9.Value) Or CDbl(Label186.Caption) > CDbl(TextBox11.Value) Then
                TextBox11.BackColor = &HFF&
            Else
                TextBox11.BackColor = "&H80000009"
            End If
        End If
    Else
        TextBox11.BackColor = &HFF&
        Worksheets("Berechnung").Cells(74, 2).Value = 0
    End If

End Sub

Private Sub TextBox12_Change()

    'Schweißnahtdicke Ring-Stirnwand
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox12.Value <> "" Then
        TextBox12.BackColor = "&H80000009"
        Worksheets("Berechnung").Cells(75, 2).Value = TextBox12.Value

        Schweißnähte

        'Falls die Schweißnähte zu groß sind für die Rippen
        If Label185.Caption <> "" Then
            If CDbl(TextBox12.Value * 2) > CDbl(TextBox9.Value) Or CDbl(Label185.Caption) > CDbl(TextBox12.Value) Then
                TextBox12.BackColor = &HFF&
            Else
                TextBox12.BackColor = "&H80000009"
            End If
        End If
    Else
```

```
    TextBox12.BackColor = &HFF&
    Worksheets("Berechnung").Cells(75, 2).Value = 0
  End If

End Sub

Private Sub TextBox13_Change()

  'Schweißnahtdicke Ring-Rippe
  'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
  If TextBox13.Value <> "" Then
    TextBox13.BackColor = "&H80000009"
    Worksheets("Berechnung").Cells(76, 2).Value = TextBox13.Value

    Schweißnähte

    'Falls die Schweißnähte zu groß sind für die Rippen bzw. den Ring
    If CDbl(TextBox13.Value * 2) > CDbl(TextBox9.Value) And CDbl(TextBox13.Value * 2) >
CDbl(TextBox8.Value) Or CDbl(Label187.Caption) > CDbl(TextBox13.Value) Then
      TextBox13.BackColor = &HFF&
    Else
      TextBox13.BackColor = "&H80000009"
    End If
  Else
    TextBox13.BackColor = &HFF&
    Worksheets("Berechnung").Cells(76, 2).Value = 0
  End If

End Sub

Private Sub TextBox2_Change()

  'Rippenhöhe
  'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
  If TextBox2.Value <> "" Then
    TextBox2.BackColor = "&H80000009"
    Worksheets("Berechnung").Cells(68, 2).Value = TextBox2.Value
    If Label192.Caption <> "" Then
      If CDbl(Label192.Caption) < CDbl(TextBox2.Value) Then
        TextBox2.BackColor = &HFF&
```

```
            Else
               TextBox2.BackColor = "&H80000009"
            End If
         End If
      Else
         TextBox2.BackColor = &HFF&
         Worksheets("Berechnung").Cells(68, 2).Value = 0
      End If

End Sub

Private Sub TextBox3_Change()

   'Schweißnahtläne Ring
   'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
   If TextBox3.Value <> "" Then
      TextBox3.BackColor = "&H80000009"
      Worksheets("Berechnung").Cells(69, 2).Value = TextBox3.Value
   Else
      TextBox3.BackColor = &HFF&
      Worksheets("Berechnung").Cells(69, 2).Value = 0
   End If

End Sub

Private Sub TextBox4_Change()
   'Durchmesser Wellenzapfen
   'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen

   If TextBox4.Value <> "" Then
      TextBox4.BackColor = "&H80000009"
      Worksheets("Berechnung").Cells(28, 2).Value = TextBox4.Value

      'Minimale Schweißnahthöhe
      ufmWellenzapfen.Label196.Caption = Worksheets("Berechnung").Cells(38, 6).Value

      'Maximale Rippenhöhe
      If TextBox8.Value <> "" Then
         '(D_Trommelschulter - D_Wellenzapfen)/2 - Dicke_Ring - 10mm
```

```
        Label192.Caption = (Worksheets("Berechnung").Cells(32, 6).Value - TextBox4.Value) / 2 -
TextBox8.Value - 10

        If CDbl(Label192.Caption) < CDbl(TextBox2.Value) Then
            TextBox2.BackColor = &HFF&
        Else
            TextBox2.BackColor = "&H80000009"
        End If
    End If

    If Label158.Caption <> "" Then
        If CDbl(TextBox4.Value) > CDbl(Label158.Caption) Then
            TextBox4.BackColor = "&H80000009"
        Else
            TextBox4.BackColor = &HFF&
        End If
    End If

    If TextBox5.Value <> "" Then
        ufmAblenkwinkel.Label226.Caption = CDbl(TextBox4.Value) - 2 * CDbl(TextBox5.Value)
    End If

  Else
    TextBox4.BackColor = &HFF&
    Worksheets("Berechnung").Cells(28, 2).Value = 0
  End If

End Sub

Private Sub TextBox5_Change()
  'Kerbradius
  'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
  If TextBox5.Value <> "" Then
    TextBox5.BackColor = "&H80000009"
    Worksheets("Berechnung").Cells(29, 2).Value = TextBox5.Value
    Label163.Caption = Worksheets("Berechnung").Cells(44, 6).Value
  Else
    TextBox5.BackColor = &HFF&
    Worksheets("Berechnung").Cells(29, 2).Value = 0
  End If
```

```
End Sub

Private Sub TextBox6_Change()
   'Schweißnahtdicke Wellenzapfen
   'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
   Dim tmax As Double
   If TextBox6.Value <> "" Then
      TextBox6.BackColor = "&H80000009"
      Worksheets("Berechnung").Cells(30, 2).Value = TextBox6.Value
      Label163.Caption = Worksheets("Berechnung").Cells(44, 6).Value

      'Bordscheibendicke-Schulterbreite
      ufmAblenkwinkel.Label26.Caption = TextBox6.Value - Worksheets("Berechnung").Cells(36,
2).Value

      'Min. Schweißnahtdicke Trommelmantel - Bordscheibe = wurzel(tmax)-0,5mm
      If Worksheets("Berechnung").Cells(30, 2).Value > Worksheets("Berechnung").Cells(18,
2).Value Then
         tmax = Worksheets("Berechnung").Cells(30, 2).Value
      Else
         tmax = Worksheets("Berechnung").Cells(18, 2).Value
      End If

      ufmSchweißnahtfreistich.Label166.Caption = tmax ^ 0.5 - 0.5

   Else
      TextBox6.BackColor = &HFF&
      ufmAblenkwinkel.Label26.Caption = "k.A."
   End If

End Sub

Private Sub TextBox7_Change()

   'Abstand Lagermitte Stirnwand
   'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
   If TextBox7.Value <> "" Then
      TextBox7.BackColor = "&H80000009"
      Worksheets("Berechnung").Cells(26, 2).Value = TextBox7.Value
```

```
        Label173.Caption = Worksheets("Berechnung").Cells(40, 6).Value

        'Minimaler Wellenzapfendurchmesser durch Abstand Lager - Trommelstirnwand
        Label163.Caption = Worksheets("Berechnung").Cells(44, 6).Value
        ufmAblenkwinkel.Label46.Caption = TextBox7.Value
    Else
        TextBox1.BackColor = &HFF&
    End If
End Sub

Private Sub TextBox8_Change()

    'Ringdicke
    'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
    If TextBox8.Value <> "" Then
        TextBox8.BackColor = "&H80000009"
        Worksheets("Berechnung").Cells(70, 2).Value = TextBox8.Value

        'Maximale Rippenhöhe
        If TextBox4.Value <> "" Then
            '(D_Trommelschulter - D_Wellenzapfen)/2 - Dicke_Ring - 10mm
            Label192.Caption = (Worksheets("Berechnung").Cells(32, 6).Value - TextBox4.Value) / 2 -
TextBox8.Value - 10

            If TextBox2.Value <> "" And Label192.Caption <> "" Then
                If CDbl(Label192.Caption) < CDbl(TextBox2.Value) Then
                    TextBox2.BackColor = &HFF&
                Else
                    TextBox2.BackColor = "&H80000009"
                End If
            End If
        End If

    Else
        TextBox8.BackColor = &HFF&
        Worksheets("Berechnung").Cells(70, 2).Value = 0
    End If

End Sub
```

```
Private Sub TextBox9_Change()

   'Rippendicke
   'Falls eine Eingabe geschieht wird der Wert sofort in die Berechnung übertragen
   If TextBox9.Value <> "" Then
      TextBox9.BackColor = "&H80000009"
      Worksheets("Berechnung").Cells(71, 2).Value = TextBox9.Value
   Else
      TextBox9.BackColor = &HFF&
      Worksheets("Berechnung").Cells(71, 2).Value = 0
   End If

End Sub
Private Sub TextBox1_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
   Case 44 To 57
   Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox2_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
   Case 44 To 57
   Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox3_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
   Case 44 To 57
   Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox4_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
   Case 44 To 57
   Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox5_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
```

```
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox6_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox7_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox8_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox9_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox10_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox11_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
```

```
  End Select
End Sub
Private Sub TextBox12_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox13_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
    Case 44 To 57
    Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox1_Enter()
    TextBox1.BackColor = &HFF00&
End Sub
Private Sub TextBox2_Enter()
    TextBox2.BackColor = &HFF00&
End Sub
Private Sub TextBox3_Enter()
    TextBox3.BackColor = &HFF00&
End Sub
Private Sub TextBox4_Enter()
    TextBox4.BackColor = &HFF00&
End Sub
Private Sub TextBox6_Enter()
    TextBox6.BackColor = &HFF00&
End Sub
Private Sub TextBox7_Enter()
    TextBox7.BackColor = &HFF00&
End Sub
Private Sub TextBox8_Enter()
    TextBox8.BackColor = &HFF00&
End Sub
Private Sub TextBox9_Enter()
    TextBox9.BackColor = &HFF00&
End Sub
Private Sub TextBox10_Enter()
```

```
    TextBox10.BackColor = &HFF00&
End Sub
Private Sub TextBox11_Enter()
    TextBox11.BackColor = &HFF00&
End Sub
Private Sub TextBox12_Enter()
    TextBox12.BackColor = &HFF00&
End Sub
Private Sub TextBox13_Enter()
    TextBox13.BackColor = &HFF00&
End Sub
```

8.2.1.17 ufmzulWerte

```
Option Explicit
Public TBNr As Integer

Private Sub CommandButton1_Click()

    Dim Kontrolvariable As Integer
    Dim i As Long
    Kontrolvariable = 0

    For i = 1 To 3
        If i Then
            If Me.Controls("TextBox" & i).Value <> "" Then
                Kontrolvariable = Kontrolvariable + 1
            End If
        End If
    Next i

    If Kontrolvariable = 3 Then
        Werte_Ändern
        Unload ufmzulWerte
    Else
        MsgBox "Es fehlen Werte für die Berechnung", vbOKOnly, "Error"
    End If

End Sub
```

```
Public Sub Werte_Ändern()

    Worksheets("Berechnung").Cells(2, 13).Value = TextBox1.Text
    Worksheets("Berechnung").Cells(3, 14).Value = TextBox2.Text
    Worksheets("Berechnung").Cells(5, 14).Value = TextBox3.Text
    'Worksheets("Berechnung").Cells(3, 18).Value = TextBox4.Text
    'Worksheets("Berechnung").Cells(5, 19).Value = TextBox5.Text
    'Worksheets("Berechnung").Cells(6, 18).Value = TextBox6.Text
    'Worksheets("Berechnung").Cells(8, 18).Value = TextBox7.Text
    'Worksheets("Berechnung").Cells(10, 19).Value = TextBox8.Text
    'Worksheets("Berechnung").Cells(11, 18).Value = TextBox9.Text
    'Worksheets("Berechnung").Cells(14, 18).Value = TextBox10.Text
    'Worksheets("Berechnung").Cells(17, 18).Value = TextBox11.Text

End Sub

Private Sub CommandButton3_Click()

    Dim i As Integer

    If TBNr = 1 Then
        Worksheets("Berechnung").Cells(2, 13).Comment.Text Text:=TextBox13.Text & ":" &
Chr(10) & TextBox12.Text
    ElseIf TBNr = 2 Then
        Worksheets("Berechnung").Cells(3, 14).Comment.Text Text:=TextBox13.Text & ":" &
Chr(10) & TextBox12.Text
    ElseIf TBNr = 3 Then
        Worksheets("Berechnung").Cells(5, 14).Comment.Text Text:=TextBox13.Text & ":" &
Chr(10) & TextBox12.Text
    End If

    For i = 1 To 3
        Me.Controls("TextBox" & i).Enabled = True
    Next i

    ufmzulWerte.Width = 296

    CommandButton1.Enabled = True

End Sub
```

```
Public Sub String_zerlegen(ByVal Eintrag As String)

    Dim i As Integer
    Dim e As Integer
    Dim Name As String
    Dim Erklärung As String

    i = InStr(Eintrag, ":")

    If i > 0 Then
        Name = Left(Eintrag, i - 1)
    End If

    Erklärung = Right(Eintrag, Len(Eintrag) - (i + 1))

    TextBox12.Text = Erklärung
    TextBox13.Text = Name

End Sub

Public Sub Eingabefelder_Sperren()

    Dim i As Long

    For i = 1 To 4
        Me.Controls("TextBox" & i).Enabled = False
    Next i

    Me.Controls("TextBox" & TBNr).Enabled = True

    ufmzulWerte.Width = 444

    CommandButton1.Enabled = False

End Sub

Private Sub TextBox1_Exit(ByVal Cancel As MSForms.ReturnBoolean)
```

```
If TextBox1.Text <> Worksheets("Berechnung").Cells(2, 13).Text Then
   TBNr = 1
   Call Eingabefelder_Sperren
   Call String_zerlegen(Worksheets("Berechnung").Cells(2, 13).Comment.Text)
End If

End Sub

Private Sub TextBox2_Exit(ByVal Cancel As MSForms.ReturnBoolean)

If TextBox2.Text <> Worksheets("Berechnung").Cells(3, 14).Text Then
   TBNr = 2
   Call Eingabefelder_Sperren
   Call String_zerlegen(Worksheets("Berechnung").Cells(3, 14).Comment.Text)
End If

End Sub

Private Sub TextBox3_Exit(ByVal Cancel As MSForms.ReturnBoolean)

If TextBox3.Text <> Worksheets("Berechnung").Cells(5, 14).Text Then
   TBNr = 3
   Call Eingabefelder_Sperren
   Call String_zerlegen(Worksheets("Berechnung").Cells(5, 14).Comment.Text)
End If

End Sub

Private Sub TextBox2_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
   Case 44 To 57
   Case Else: KeyAscii = 0
  End Select
End Sub
Private Sub TextBox3_KeyPress(ByVal KeyAscii As MSForms.ReturnInteger)
  Select Case KeyAscii
   Case 44 To 57
   Case Else: KeyAscii = 0
```

```
  End Select
End Sub
```

8.2.1.18 Modul1

```
Option Explicit

Public Check As Integer

Public Sub Einstufung_psi()

    Dim Einstufung As String
    Dim i As Integer
    Dim j As Integer

    Einstufung = ufmParametereingabe.ComboBox2.Text

    For i = 1 To Worksheets("Einstufung B4004").Cells(65536, 1).End(xlUp).Row

        'Falls die ausgewählte Einstufung dem Eintrag entspricht werden die Parameter übertra-
gen

        If Worksheets("Einstufung B4004").Cells(i, 1).Text = Einstufung Then

            If Worksheets("Berechnung").Cells(3, 2).Value <= 90 Then

                'Falls Hubgeschwindigkeit kleiner gleich 90m/min
                Worksheets("Berechnung").Cells(7, 6).Value = Worksheets("Einstufung
B4004").Cells(i, 2).Value
            Else
                'Falls Hubgeschwindigkeit größer 90m/min
                Worksheets("Berechnung").Cells(7, 6).Value = Worksheets("Einstufung
B4004").Cells(i, 3).Value
            End If
        End If

    Next i
End Sub

Public Sub Seildurchmesser()
```

```
'Berechnung des Seilgewichtes
Dim k As Integer
Dim i As Integer
Dim Seilgewicht As Double
Dim Anzahl_Flaschenzüge As Double
Dim Anzahl_wirks_Seilstränge As Double
Dim Hubhöhe As Double
Dim parallele_Seilstränge As Double
Dim d_min As Double

'Werte aus Berechnung auslesen
Hubhöhe = Worksheets("Berechnung").Cells(4, 2)
Anzahl_Flaschenzüge = Worksheets("Berechnung").Cells(9, 2)
Anzahl_wirks_Seilstränge = Worksheets("Berechnung").Cells(10, 2)
parallele_Seilstränge = Worksheets("Berechnung").Cells(12, 2)
k = 0

'Nur wenn nicht durch Null dividiert wird bzw. keine Werte fehlen DIN 15020
If Worksheets("Berechnung").Cells(9, 10).Text <> "#DIV/0!" And Worksheets("Berechnung").Cells(9, 10).Text <> "#ZAHL!" Then

    'Schleife bis zum letzten Eintrag
    For i = 1 To Worksheets("Seile").Cells(65536, 1).End(xlUp).Row

    'Seilgewicht = spez. Seilgewicht(kg/100m) * Hubhöhe * Anzahl Flaschenzüge * Anzahl wirksamer Seilstränge pro Flaschenzug

    Seilgewicht = Worksheets("Seile").Cells(1 + i, 2) * Hubhöhe * Anzahl_Flaschenzüge * Anzahl_wirks_Seilstränge * parallele_Seilstränge

    'Seilgewicht in Berechnung übertragen
    Worksheets("Berechnung").Cells(8, 6) = Seilgewicht

    'Den dadurch errechneten minimalen Seildurchmesser auslesen
    d_min = Worksheets("Berechnung").Cells(9, 10).Value

    'Falls der errechnete minimale Seildurchmesser kleiner ist als der mit dessen speziefischem Gewicht gerechnet wurde,
    'wird der Wert in das Label übertragen und die Schleife unterbrochen
        If d_min < Worksheets("Seile").Cells(1 + i, 1).Value Then
            k = k + 1
```

```
                If k = 1 Then
                    ufmParametereingabe.Label40.Caption = d_min
                    i = Worksheets("Seile").Cells(65536, 1).End(xlUp).Row
                End If
            End If

        Next i
    End If

    'Falls das Label und die ComboBox ungleich null sind und der eingegebene Wert kleiner ist als der Berechnete
    If ufmParametereingabe.Label40.Caption <> "" Then
        If ufmParametereingabe.ComboBox4.Value < CDbl(ufmParametereingabe.Label40.Caption) And ufmParametereingabe.ComboBox4.Value <> "" Then
            MsgBox "Gewählter Seildurchmesser kleiner als berechneter minimaler Seildurchmesser!"
        End If
    End If

    Seilklemmkraft

End Sub

Public Sub Kupplungsberechnung()

    Dim Kupplungsnummer As Double
    Dim Drehmoment_T_max As Double
    Dim Radiallast_F_korr As Double
    Dim Drehm_check(1 To 65536) As Double
    Dim Rad_check(1 To 65536) As Double
    Dim Radiallast_gegeben As Double
    Dim i As Integer
    Dim D6_Kupplung As Double

    'Schätzwerte eintragen
    'Falls die Seiltrommelart einfach ist
    If Worksheets("Berechnung").Cells(16, 2).Value = 1 Then
        If Worksheets("Berechnung").Cells(26, 2).Value = "" Then
            Worksheets("Berechnung").Cells(26, 2).Value = 110
        End If
```

```
        If Worksheets("Berechnung").Cells(34, 2).Value = "" Then
            Worksheets("Berechnung").Cells(34, 2).Value = Worksheets("Berechnung").Cells(50, 6).Value
        End If
        If Worksheets("Berechnung").Cells(33, 2).Value = "" Then
            'Falls Kupplungsseitig geklemmt wird
            If Worksheets("Berechnung").Cells(33, 2).Value = 1 Then
                Worksheets("Berechnung").Cells(33, 2).Value = Worksheets("Berechnung").Cells(48, 6).Value
            Else
                Worksheets("Berechnung").Cells(33, 2).Value = 2 * Worksheets("Berechnung").Cells(13, 2).Value
            End If
        End If
    End If

    'Wert aus der Berechnung auslesen
    Drehmoment_T_max = Worksheets("Berechnung").Cells(49, 10).Value * 1000 'Einheiten Umrechnen von [kNm] auf [Nm]
    Kupplungsnummer = "0,25"

    'Einlesen aller zul. Drehmomente und Radiallasten für alle Kupplungen (-1 weil die erste Zeile zur Beschreibung dient und keine Kupplungswerte darstellt)
    'Multipliziert mit dem Minderungsfaktor für 3 Schichtbetrieb [%] (nur Drehmoment)
    For i = 1 To Worksheets("Malmediekupplungen").Cells(65536, 1).End(xlUp).Row - 1
        Drehm_check(i) = Worksheets("Malmediekupplungen").Cells(i + 1, 20).Value * (1 - Worksheets("Berechnung").Cells(23, 2).Value / 100)
        Rad_check(i) = Worksheets("Malmediekupplungen").Cells(i + 1, 21).Value
    Next i

    'Auswahl nach zulässigem Drehmoment beginnend vom Größten
    For i = Worksheets("Malmediekupplungen").Cells(65536, 1).End(xlUp).Row - 1 To 1 Step -1

        If Drehm_check(i) < Drehmoment_T_max Then

            If i = Worksheets("Malmediekupplungen").Cells(65536, 1).End(xlUp).Row - 1 Then

                'Falls in der ersten Iteration das Drehmoment bereits zu groß ist, gibt es keine Kupplung zur Auswahl
                MsgBox "Beanspruchung zu groß"
            Else
                '
```

```
            Kupplungsnummer = Worksheets("Malmediekupplungen").Cells(i + 2, 1).Value
            'Worksheets("Berechnung").Cells(47, 10).Value = Worksheets("Malmediekupplungen").Cells(i + 2, 21).Value
        End If
        i = 0
    End If
Next i

'Einlesen der gegebenen Radiallast
Radiallast_gegeben = Worksheets("Berechnung").Cells(47, 10).Value

'Auswahl nach der korrigierten Radiallast
For i = Worksheets("Malmediekupplungen").Cells(65536, 1).End(xlUp).Row - 1 To 1 Step -1

    Worksheets("Berechnung").Cells(13, 6).Value = Drehm_check(i)
    Worksheets("Berechnung").Cells(14, 6).Value = Rad_check(i)

    'korrigierte Radiallast
    Radiallast_F_korr = Worksheets("Berechnung").Cells(54, 10).Value

    If Radiallast_gegeben > Radiallast_F_korr Then
        If Kupplungsnummer < Worksheets("Malmediekupplungen").Cells(i + 1, 1).Value Then
            Kupplungsnummer = Worksheets("Malmediekupplungen").Cells(i + 1, 1).Value
            i = 0
        End If
    End If
Next i

If Drehmoment_T_max > 1100000 Or Radiallast_gegeben > 550000 Then '"Radiallast > korrigierte Radiallast bei größter Kupplung
    MsgBox "Beanspruchung zu groß"
Else
    ufmParametereingabe.Label64.Caption = Kupplungsnummer
    'Kerf für Kupplungsauswahl
    ufmParametereingabe.Label76.Caption = Worksheets("Berechnung").Cells(18, 6).Value

    'zul. Werte für Kupplung in die Berechnung schreiben
    For i = 1 To Worksheets("Malmediekupplungen").Cells(65536, 1).End(xlUp).Row
        If Worksheets("Malmediekupplungen").Cells(i, 1).Value = Kupplungsnummer Then
```

```
            Worksheets("Berechnung").Cells(13, 6).Value = Worksheets("Malmediekupplungen").Cells(i, 20).Value
            Worksheets("Berechnung").Cells(14, 6).Value = Worksheets("Malmediekupplungen").Cells(i, 21).Value
        End If
    Next i

End If

'Größte Kupplung nach Trommeldurchmesser (noch nicht korrekt, da die Dicke der Seiltrommel fehlt

Dim DBordscheibenschulter As Double

DBordscheibenschulter = Worksheets("Berechnung").Cells(32, 6).Value

For i = 2 To Worksheets("Malmediekupplungen").Cells(65536, 1).End(xlUp).Row
    If Worksheets("Malmediekupplungen").Cells(i, 18).Value < DBordscheibenschulter Then
        ufmParametereingabe.Label65.Caption = Worksheets("Malmediekupplungen").Cells(i, 1).Value
    End If
Next i
End Sub

Public Sub Passfederwahl()

Dim Wellendurchmesser As Double
Dim i As Integer

Wellendurchmesser = Worksheets("Berechnung").Cells(24, 2).Value

For i = 2 To Worksheets("Passfeder").Cells(65536, 1).End(xlUp).Row
    If Wellendurchmesser > Worksheets("Passfeder").Cells(i, 1).Value Then
        Worksheets("Berechnung").Cells(21, 6).Value = Worksheets("Passfeder").Cells(i, 4).Value
        Worksheets("Berechnung").Cells(22, 6).Value = Worksheets("Passfeder").Cells(i, 5).Value
        Worksheets("Berechnung").Cells(23, 6).Value = Worksheets("Passfeder").Cells(i, 3).Value

        'Werte in Tabelle1 übertragen
        Worksheets("Tabelle1").Cells(2, 25).Value = Worksheets("Passfeder").Cells(i, 3).Value
        Worksheets("Tabelle1").Cells(2, 26).Value = Worksheets("Passfeder").Cells(i, 6).Value
```

```
    End If
  Next i

  'Passfederanzahl auf 1 setzen
  Worksheets("Berechnung").Cells(24, 6).Value = 1

  'Nur wenn nicht durch Null dividiert wird bzw. keine Werte fehlen
  If Worksheets("Berechnung").Cells(77, 10).Text <> "#DIV/0!" And Worksheets("Berechnung").Cells(77, 10).Text <> "#ZAHL!" Then

    'perf < pzul bei einer passfeder
    If CDbl(Worksheets("Berechnung").Cells(77, 10).Text) < CDbl(Worksheets("Berechnung").Cells(3, 18).Text) Then
      'Wenn eine Passfeder ausreichend ist, werden die Images auf weiß gestellt
      ufmParametereingabe.Image1.BackColor = &H80000009
      ufmParametereingabe.Image2.BackColor = &H80000009
      ufmParametereingabe.Image3.BackColor = &H80000009
      ufmParametereingabe.Image4.BackColor = &H80000009
      ufmParametereingabe.Image1.BorderColor = &H80000009
      ufmParametereingabe.Image2.BorderColor = &H80000009
      ufmParametereingabe.Image3.BorderColor = &H80000009
      ufmParametereingabe.Image4.BorderColor = &H80000009
    Else
      Worksheets("Berechnung").Cells(24, 6).Value = 2
      If CDbl(Worksheets("Berechnung").Cells(77, 10).Text) < CDbl(Worksheets("Berechnung").Cells(3, 18).Text) Then
        'Falls zwei Passfedern ausreichen wird nur das Image mit einer Passfeder auf rot gesetzt
        ufmParametereingabe.Image1.BackColor = &HFF&
        ufmParametereingabe.Image1.BorderColor = &HFF&
        ufmParametereingabe.Image2.BackColor = &H80000009
        ufmParametereingabe.Image3.BackColor = &H80000009
        ufmParametereingabe.Image4.BackColor = &H80000009
        ufmParametereingabe.Image2.BorderColor = &H80000009
        ufmParametereingabe.Image3.BorderColor = &H80000009
        ufmParametereingabe.Image4.BorderColor = &H80000009
      Else
        'Falls die Beanspruchung für zwei Passfedern zu groß ist werden alle Images auf rot gesetzt
        ufmParametereingabe.Image1.BackColor = &HFF&
        ufmParametereingabe.Image1.BorderColor = &HFF&
```

```
        ufmParametereingabe.Image2.BackColor = &HFF&
        ufmParametereingabe.Image3.BackColor = &HFF&
        ufmParametereingabe.Image4.BackColor = &HFF&
        ufmParametereingabe.Image2.BorderColor = &HFF&
        ufmParametereingabe.Image3.BorderColor = &HFF&
        ufmParametereingabe.Image4.BorderColor = &HFF&
      End If
    End If
  End If
  If ufmParametereingabe.Passfeder_1 = True Then
    Worksheets("Berechnung").Cells(24, 6).Value = 1
  Else
    Worksheets("Berechnung").Cells(24, 6).Value = 2
  End If

End Sub

Public Sub Seiltrommeldicke_Solver()

  'Das Activesheet ändern, da sonst der Solver auf das Falsche Blatt zugreift
  Sheets("Berechnung").Activate
  'Suchen der minimalen Seiltrommeldicke mittels SOLVER
  SolverOk SetCell:="$F$28", MaxMinVal:=2, ValueOf:="0", ByChange:="$F$28"
  SolverAdd CellRef:="$J$85", Relation:=1, FormulaText:="$R$6"
  SolverAdd CellRef:="$F$28", Relation:=3, FormulaText:="1"
  SolverSolve Userfinish:=True
  SolverReset

End Sub

Public Sub Seilklemmkraft()

  If ufmParametereingabe.TextBox11.Value <> "" And ufmParametereingabe.ComboBox4.Value <> "" And ufmParametereingabe.TextBox17.Value <> "" And Worksheets("Tabelle1").Cells(2, 2).Value = "Trommel" Then
    ufmParametereingabe.Label106.Caption = Worksheets("Berechnung").Cells(53, 14).Value
  End If
  If ufmParametereingabe.TextBox11.Value <> "" And ufmParametereingabe.ComboBox4.Value <> "" And ufmParametereingabe.TextBox17.Value <> "" And Worksheets("Tabelle1").Cells(2, 2).Value = "Bord" And ufmParametereingabe.TextBox20.Value <> ""
```

```
And ufmParametereingabe.TextBox21.Value <> "" And ufmParametereingabe.TextBox22.Value <> "" And ufmParametereingabe.TextBox23.Value <> "" Then
        ufmParametereingabe.Label106.Caption = Worksheets("Berechnung").Cells(53, 18).Value
    End If

End Sub

Public Sub Restdicke_Seiltrommel()
    If ufmSchweißnahtfreistich.TextBox1.BackColor <> &HFF& And ufmSchweißnahtfreistich.TextBox4.BackColor <> &HFF& And ufmSchweißnahtfreistich.TextBox6.BackColor <> &HFF& Then
        ufmSchweißnahtfreistich.Label181.Caption = CDbl(ufmSchweißnahtfreistich.TextBox6.Value) - ufmSchweißnahtfreistich.TextBox1.Value - ufmSchweißnahtfreistich.TextBox4.Value
    End If
End Sub

Public Sub Aktualisierung()

    Check = Check + 1
    If Check > 2 Then

        'Laden der berechneten Minimalabmessungen
        ufmAblenkwinkel.Label11.Caption = Worksheets("Berechnung").Cells(25, 10).Value 'Ausgleichsrolle
        ufmAblenkwinkel.Label15.Caption = Worksheets("Berechnung").Cells(45, 6).Value '-Wicklungslänge
        ufmAblenkwinkel.Label17.Caption = Worksheets("Berechnung").Cells(48, 6).Value '-Klemmlänge (fix)
        ufmAblenkwinkel.Label19.Caption = Worksheets("Berechnung").Cells(49, 6).Value '-Bordscheibendicke Kupplungsseitig
        ufmAblenkwinkel.Label13.Caption = Worksheets("Berechnung").Cells(4, 2).Value 'Hub-länge
        ufmAblenkwinkel.Label22.Caption = Worksheets("Berechnung").Cells(15, 2).Value '-Trommeldurchmesser
        ufmAblenkwinkel.Label24.Caption = Worksheets("Berechnung").Cells(17, 2).Value '-Bordscheibendurchmesser
        ufmAblenkwinkel.Label28.Caption = Worksheets("Berechnung").Cells(32, 2).Value '-Schweißnahtfreistich
        ufmAblenkwinkel.Label26.Caption = Worksheets("Berechnung").Cells(30, 2).Value - Worksheets("Berechnung").Cells(36, 2).Value 'Bordscheibendicke Lagerseitig
        ufmAblenkwinkel.Label54.Caption = Worksheets("Berechnung").Cells(63, 6).Value '-Kupplungsaufmaß
```

```
'Mindestabstand Bordscheibe = Schweißnahtfreistich + Klemmlänge (fix)
'If ufmAblenkwinkel.TextBox9.Value = "" Or ufmAblenkwinkel.TextBox9.Value = 0 Then
'    ufmAblenkwinkel.Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value + Worksheets("Berechnung").Cells(48, 6).Value
'Else
'    ufmAblenkwinkel.Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value + Worksheets("Berechnung").Cells(48, 6).Value + ufmAblenkwinkel.TextBox9.Value + "5"
'End If

If Worksheets("Tabelle1").Cells(2, 1).Value = "Doppelt" Then
  'Doppelt

  'Minimale Gesamtlänge
  If Worksheets("Tabelle1").Cells(2, 3).Value = "außen" Then
    'Doppelt/außen
    'Mindestabstand links Bordscheibe
    If ufmAblenkwinkel.TextBox9.Value = "" Or ufmAblenkwinkel.TextBox9.Value = 0 Then
      ufmAblenkwinkel.Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value + Worksheets("Berechnung").Cells(48, 6).Value
    Else
      ufmAblenkwinkel.Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value + Worksheets("Berechnung").Cells(48, 6).Value + ufmAblenkwinkel.TextBox9.Value + "5"
    End If

    'Mindestmittenlänge = Seildurchmesser
    ufmAblenkwinkel.Label43.Caption = Worksheets("Berechnung").Cells(13, 2).Value

    If Worksheets("Tabelle1").Cells(2, 2).Value = "Bord" Then
      'Doppelt/außen/Bord
      'Klemmlänge gewählt = Klemmlänge für Bordscheibenklemmung
      Worksheets("Berechnung").Cells(33, 2).Value = Worksheets("Berechnung").Cells(48, 6).Value
      ufmAblenkwinkel.Label32.Visible = False
      ufmAblenkwinkel.Label33.Visible = False
      ufmAblenkwinkel.Label34.Visible = False
      ufmAblenkwinkel.Label27.Visible = False
      ufmAblenkwinkel.Label28.Visible = False
      ufmAblenkwinkel.Label29.Visible = False
      ufmAblenkwinkel.TextBox9.Visible = False
      ufmAblenkwinkel.Label10.Visible = False
```

```
            ufmAblenkwinkel.TextBox8.Visible = False
            ufmAblenkwinkel.TextBox8.BackColor = "&H80000009"
            'Klemmlänge, linke Restlänge
            ufmAblenkwinkel.TextBox8.Value = Worksheets("Berechnung").Cells(48, 6).Value
            ufmAblenkwinkel.Label17.Top = 86
            ufmAblenkwinkel.Label17.Left = 132
            ufmAblenkwinkel.Label18.Top = 86
            ufmAblenkwinkel.Label18.Left = 160
            'Minmale Gesamtlänge = 2*(Klemmlänge+Wicklungslänge)+Bordscheibe Kupplungss. + Bordscheibe Wellenseitig-Bordscheibenschulter Wellenseitig + Seildurchmesser
            ufmAblenkwinkel.Label39.Caption = 2 * (Worksheets("Berechnung").Cells(48, 6).Value + Worksheets("Berechnung").Cells(45, 6).Value) + Worksheets("Berechnung").Cells(49, 6).Value + Worksheets("Berechnung").Cells(30, 2).Value - Worksheets("Berechnung").Cells(36, 2).Value + Worksheets("Berechnung").Cells(13, 2).Value
        Else
            'Doppelt/außen/Trommel
            'Minmale Gesamtlänge = 2*(Klemmlänge+Wicklungslänge)+Bordscheibe Kupplungss. + Bordscheibe Wellenseitig + Bordscheibe Kupplungsseitig + Mittenabstand
            ufmAblenkwinkel.Label39.Caption = 2 * (CInt(ufmAblenkwinkel.Label33.Caption) + CInt(ufmAblenkwinkel.Label15.Caption)) + CInt(ufmAblenkwinkel.Label43.Caption) + CInt(ufmAblenkwinkel.Label19.Caption) + CInt(ufmAblenkwinkel.Label26.Caption)


        End If
    Else
        'Doppelt/innen
        'Mindestmittenlänge = 2 x Klemmlänge
        ufmAblenkwinkel.Label43.Caption = 2 * Worksheets("Berechnung").Cells(48, 6).Value


        'Mindestabstand links Bordscheibe
        If ufmAblenkwinkel.TextBox9.Value = "" Or ufmAblenkwinkel.TextBox9.Value = 0 Then
            ufmAblenkwinkel.Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value + Worksheets("Berechnung").Cells(20, 6).Value - Worksheets("Berechnung").Cells(13, 2).Value / 2
        Else
            ufmAblenkwinkel.Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value + ufmAblenkwinkel.TextBox9.Value + "5" + Worksheets("Berechnung").Cells(20, 6).Value - Worksheets("Berechnung").Cells(13, 2).Value / 2
        End If


        'Minmale Gesamtlänge = 2*(Klemmlänge+Wicklungslänge)+Bordscheibe Kupplungss. + Bordscheibe Wellenseitig + Bordscheibe Kupplungsseitig + Mittenabstand
        ufmAblenkwinkel.Label39.Caption = 2 * (CInt(ufmAblenkwinkel.Label33.Caption) + CInt(ufmAblenkwinkel.Label15.Caption)) + CInt(ufmAblenkwinkel.Label43.Caption) + CInt(ufmAblenkwinkel.Label19.Caption) + CInt(ufmAblenkwinkel.Label26.Caption)
```

```
    If Worksheets("Tabelle1").Cells(2, 2).Value = "Bord" Then
      'Doppelt/innen/Bord
    Else
      'Doppelt/innen/Trommel
    End If
  End If
Else
  'Einfach
  'Verschieben der Einzelnen Label und Textboxen bei einfachen Seiltrommeln
  ufmAblenkwinkel.Label38.Left = 442
  ufmAblenkwinkel.Label39.Left = 414
  ufmAblenkwinkel.Label40.Left = 396
  ufmAblenkwinkel.Label1.Left = 336
  ufmAblenkwinkel.Label5.Left = 372
  ufmAblenkwinkel.Label4.Left = 348
  ufmAblenkwinkel.Label6.Left = 444
  ufmAblenkwinkel.Label6.Top = 72
  ufmAblenkwinkel.Label8.Left = 192
  ufmAblenkwinkel.Label30.Left = 384
  ufmAblenkwinkel.Label30.Top = 130
  ufmAblenkwinkel.TextBox3.Left = 342
  ufmAblenkwinkel.TextBox2.Left = 318
  ufmAblenkwinkel.TextBox4.Left = 414
  ufmAblenkwinkel.TextBox4.Top = 66
  ufmAblenkwinkel.TextBox6.Left = 162
  ufmAblenkwinkel.TextBox10.Left = 354
  ufmAblenkwinkel.TextBox10.Top = 126
  ufmAblenkwinkel.Label37.Left = 408
  ufmAblenkwinkel.Label35.Left = 455
  ufmAblenkwinkel.Label36.Left = 429
  ufmAblenkwinkel.Label37.Top = 130
  ufmAblenkwinkel.Label35.Top = 130
  ufmAblenkwinkel.Label36.Top = 130
  ufmAblenkwinkel.Label11.Top = 510
  ufmAblenkwinkel.Label12.Top = 512
  ufmAblenkwinkel.Label11.Left = 228
  ufmAblenkwinkel.Label12.Left = 254
```

```
If Worksheets("Tabelle1").Cells(2, 3).Value = "außen" Then
    'Einfach/außen
    'Mindestabstand links Bordscheibe

    If ufmAblenkwinkel.TextBox9.Value = "" Or ufmAblenkwinkel.TextBox9.Value = 0 Then
        ufmAblenkwinkel.Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value + Worksheets("Berechnung").Cells(48, 6).Value
    Else
        ufmAblenkwinkel.Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value + Worksheets("Berechnung").Cells(48, 6).Value + ufmAblenkwinkel.TextBox9.Value + "5"
    End If



    If Worksheets("Tabelle1").Cells(2, 2).Value = "Bord" Then
        'Einfach/außen/Bord
        'Klemmlänge gewählt = Klemmlänge für Bordscheibenklemmung
        Worksheets("Berechnung").Cells(33, 2).Value = Worksheets("Berechnung").Cells(48, 6).Value
        ufmAblenkwinkel.TextBox9.Visible = False
        ufmAblenkwinkel.Label10.Visible = False
        ufmAblenkwinkel.TextBox8.Visible = False
        ufmAblenkwinkel.TextBox8.BackColor = "&H80000009"

        ufmAblenkwinkel.TextBox8.Value = Worksheets("Berechnung").Cells(48, 6).Value
        ufmAblenkwinkel.Label27.Visible = False
        ufmAblenkwinkel.Label28.Visible = False
        ufmAblenkwinkel.Label29.Visible = False
        'Mindestabstand rechts = Schweißnahtfreistich + Seilrillensteigung - Seildurchmesser/2
        ufmAblenkwinkel.Label43.Caption = Worksheets("Berechnung").Cells(32, 2).Value + Worksheets("Berechnung").Cells(20, 6).Value - Worksheets("Berechnung").Cells(13, 2).Value / 2
        ufmAblenkwinkel.Label42.Left = 515
        ufmAblenkwinkel.Label43.Left = 488
        ufmAblenkwinkel.Label44.Left = 470
        ufmAblenkwinkel.Label42.Top = 72
        ufmAblenkwinkel.Label43.Top = 70
        ufmAblenkwinkel.Label44.Top = 72
        ufmAblenkwinkel.Label39.Caption = Worksheets("Berechnung").Cells(50, 6).Value
        'Linke Klemmlänge ausblenden
        ufmAblenkwinkel.Label32.Visible = False
```

```
            ufmAblenkwinkel.Label33.Visible = False
            ufmAblenkwinkel.Label34.Visible = False
            ufmAblenkwinkel.Label33.Caption = 0
            ufmAblenkwinkel.Label17.Left = 294
            ufmAblenkwinkel.Label18.Left = 321
            ufmAblenkwinkel.Label17.Top = 408
            ufmAblenkwinkel.Label18.Top = 410

        Else
            'Einfach/außen/Trommel
            'Mindestmittenlänge = Schweißnahtfreistich + Seilrillensteigung - Seildurchmes-
ser/2
            ufmAblenkwinkel.Label43.Caption = Worksheets("Berechnung").Cells(32, 2).Value +
Worksheets("Berechnung").Cells(20, 6).Value - Worksheets("Berechnung").Cells(13, 2).Value / 2
            ufmAblenkwinkel.Label42.Left = 515
            ufmAblenkwinkel.Label43.Left = 488
            ufmAblenkwinkel.Label44.Left = 470
            ufmAblenkwinkel.Label42.Top = 72
            ufmAblenkwinkel.Label43.Top = 70
            ufmAblenkwinkel.Label44.Top = 72
            'Minmale Gesamtlänge = Klemmlänge + Wicklungslänge + Bordscheibe Kupplungss.
+ Bordscheibe Wellenseitig + Mittenabstand
            ufmAblenkwinkel.Label39.Caption = CInt(ufmAblenkwinkel.Label33.Caption) +
CInt(ufmAblenkwinkel.Label15.Caption) + CInt(ufmAblenkwinkel.Label43.Caption) +
CInt(ufmAblenkwinkel.Label19.Caption) + CInt(ufmAblenkwinkel.Label26.Caption)
            ufmAblenkwinkel.Label28.Left = 312
            ufmAblenkwinkel.Label27.Left = 340
            ufmAblenkwinkel.TextBox9.Left = 330
            ufmAblenkwinkel.Label29.Left = 362
            ufmAblenkwinkel.Label17.Left = 330
            ufmAblenkwinkel.Label18.Left = 357
            ufmAblenkwinkel.Label28.Top = 456
            ufmAblenkwinkel.Label27.Top = 458
            ufmAblenkwinkel.TextBox9.Top = 432
            ufmAblenkwinkel.Label29.Top = 436
            ufmAblenkwinkel.Label17.Top = 414
            ufmAblenkwinkel.Label18.Top = 416
        End If
    Else
        'Einfach/innen
        'Mindestabstand links Bordscheibe
```

```
If ufmAblenkwinkel.TextBox9.Value = "" Or ufmAblenkwinkel.TextBox9.Value = 0 Then
    ufmAblenkwinkel.Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value + Worksheets("Berechnung").Cells(20, 6).Value - Worksheets("Berechnung").Cells(13, 2).Value / 2
Else
    ufmAblenkwinkel.Label33.Caption = Worksheets("Berechnung").Cells(32, 2).Value + ufmAblenkwinkel.TextBox9.Value + "5" + Worksheets("Berechnung").Cells(20, 6).Value - Worksheets("Berechnung").Cells(13, 2).Value / 2
End If

ufmAblenkwinkel.Label28.Top = 360
ufmAblenkwinkel.Label27.Top = 362
ufmAblenkwinkel.TextBox9.Top = 384
ufmAblenkwinkel.Label29.Top = 388
ufmAblenkwinkel.Label17.Top = 408
ufmAblenkwinkel.Label18.Top = 410

If Worksheets("Tabelle1").Cells(2, 2).Value = "Bord" Then
    'Einfach/innen/Bord
    'Klemmlänge gewählt = Klemmlänge für Bordscheibenklemmung
    Worksheets("Berechnung").Cells(33, 2).Value = CDbl(ufmAblenkwinkel.Label33.Caption)
    Worksheets("Berechnung").Cells(44, 2).Value = Worksheets("Berechnung").Cells(48, 6).Value
    ufmAblenkwinkel.Label35.Visible = False
    ufmAblenkwinkel.Label37.Visible = False
    ufmAblenkwinkel.Label36.Visible = False
    ufmAblenkwinkel.Label30.Visible = False
    ufmAblenkwinkel.TextBox10.Visible = False
    ufmAblenkwinkel.TextBox4.Visible = False
    ufmAblenkwinkel.TextBox4.BackColor = "&H80000009"
    ufmAblenkwinkel.TextBox4.Value = Worksheets("Berechnung").Cells(48, 6).Value
    ufmAblenkwinkel.Label6.Visible = False
    'Mindestmittenlänge ausblenden
    ufmAblenkwinkel.Label42.Left = 460
    ufmAblenkwinkel.Label43.Left = 433
    ufmAblenkwinkel.Label44.Left = 415
    ufmAblenkwinkel.Label42.Top = 72
    ufmAblenkwinkel.Label43.Top = 70
    ufmAblenkwinkel.Label44.Top = 72
```

```
            ufmAblenkwinkel.Label43.Caption = Worksheets("Berechnung").Cells(48, 6).Value
            ufmAblenkwinkel.Label39.Caption = Worksheets("Berechnung").Cells(57, 6).Value
            ufmAblenkwinkel.Label28.Left = 234
            ufmAblenkwinkel.Label27.Left = 262
            ufmAblenkwinkel.TextBox9.Left = 246
            ufmAblenkwinkel.Label29.Left = 278
            ufmAblenkwinkel.Label17.Left = 318
            ufmAblenkwinkel.Label18.Left = 345
          Else
            'Einfach/innen/Trommel
            ufmAblenkwinkel.Label43.Caption = Worksheets("Berechnung").Cells(48, 6).Value + Worksheets("Berechnung").Cells(32, 2).Value
            ufmAblenkwinkel.Label42.Left = 515
            ufmAblenkwinkel.Label43.Left = 488
            ufmAblenkwinkel.Label44.Left = 470
            ufmAblenkwinkel.Label42.Top = 72
            ufmAblenkwinkel.Label43.Top = 70
            ufmAblenkwinkel.Label44.Top = 72
            ufmAblenkwinkel.Label28.Left = 222
            ufmAblenkwinkel.Label27.Left = 250
            ufmAblenkwinkel.TextBox9.Left = 240
            ufmAblenkwinkel.Label29.Left = 272
            ufmAblenkwinkel.Label17.Left = 330
            ufmAblenkwinkel.Label18.Left = 357
            'Minmale Gesamtlänge = Klemmlänge + Wicklungslänge +Bordscheibe Kupplungss. + Bordscheibe Wellenseitig + Mittenabstand
            ufmAblenkwinkel.Label39.Caption = CInt(ufmAblenkwinkel.Label33.Caption) + CInt(ufmAblenkwinkel.Label15.Caption) + CInt(ufmAblenkwinkel.Label43.Caption) + CInt(ufmAblenkwinkel.Label19.Caption) + CInt(ufmAblenkwinkel.Label26.Caption)
          End If
        End If
      End If

      'Falls die Berechnung verändert wird und Werte schon vorhanden sind
      If Worksheets("Berechnung").Cells(80, 2).Value = 2 Then
        'Ablenkwinkel
        ufmAblenkwinkel.TextBox1.Value = Worksheets("Berechnung").Cells(43, 2).Value
        ufmAblenkwinkel.TextBox3.Value = Worksheets("Tabelle1").Cells(2, 91).Value
        ufmAblenkwinkel.TextBox8.Value = Worksheets("Tabelle1").Cells(2, 92).Value
        ufmAblenkwinkel.TextBox4.Value = Worksheets("Tabelle1").Cells(2, 93).Value
        If ufmAblenkwinkel.TextBox9.Enabled = True Then
```

```
            ufmAblenkwinkel.TextBox9.Value = Worksheets("Berechnung").Cells(41, 2).Value
        End If
        If ufmAblenkwinkel.TextBox10.Enabled = True Then
            ufmAblenkwinkel.TextBox10.Value = Worksheets("Berechnung").Cells(42, 2).Value
        End If
        ufmAblenkwinkel.TextBox2.Value = Worksheets("Berechnung").Cells(20, 2).Value
        ufmAblenkwinkel.TextBox7.Value = Worksheets("Berechnung").Cells(39, 2).Value
        ufmAblenkwinkel.TextBox6.Value = Worksheets("Berechnung").Cells(40, 2).Value
    End If

    ufmAblenkwinkel.Show
Else
    If Check > 1 Then

        'Minimale Schweißnahthöhe
        ufmSchweißnahtfreistich.Show
    Else

        'Abschätzwerte für Schweißnahtberechnung
        'falls die Werte nicht eingelesen werden
        If Worksheets("Berechnung").Cells(80, 2).Value = 1 Then
            'Abstand Festlager
            Worksheets("Berechnung").Cells(26, 2).Value = 110
            'dwzamin
            Worksheets("Berechnung").Cells(28, 2).Value = 130
            'Schweißnahtfreistich
            Worksheets("Berechnung").Cells(30, 2).Value = 30
            'Wellenzapfenlänge
            Worksheets("Berechnung").Cells(31, 2).Value = 150
            'Minimale Gesamt- und Restlänge
            Worksheets("Berechnung").Cells(34,                    2).Value                    =
CDbl(ufmAblenkwinkel.Label39.Caption)
        End If

        ufmWellenzapfen.Label173.Caption = Worksheets("Berechnung").Cells(40, 6).Value
        ufmWellenzapfen.Label163.Caption = Worksheets("Berechnung").Cells(44, 6).Value
        ufmWellenzapfen.Label196.Caption = Worksheets("Berechnung").Cells(38, 6).Value
        ufmWellenzapfen.Show
    End If
End If
```

```
End Sub

Public Sub Klemmfaktor()

    Dim Klemmfaktor As Double
    Dim a As Double
    Dim B As Double

    If ufmParametereingabe.TextBox22.Value <> "" And ufmParametereingabe.TextBox23.Value
<> "" Then
        a = ufmParametereingabe.TextBox22.Value
        B = ufmParametereingabe.TextBox23.Value
        Klemmfaktor = B / (a + B)
        Worksheets("Berechnung").Cells(46, 2).Value = Klemmfaktor
    Else
        Worksheets("Berechnung").Cells(46, 2).Value = 0.5
    End If

End Sub

Public Sub Seilberechnung_CEN13001_statisch()

    Dim F_Sds As Double
    Dim F_Rds As Double
    Dim i As Integer
    Dim a As Integer

    a = 0

    For i = 1 To 9
        If ufmSeilberechnung.Controls("TextBox" & i).Value <> "" Then
            a = a + 1
            If ufmSeilberechnung.ComboBox1.Value <> "" And ufmSeilberech-
nung.ComboBox2.Value <> "" And ufmSeilberechnung.ComboBox3.Value <> "" And a = 9 Then
                F_Sds = Worksheets("Berechnung").Cells(77, 6).Value
                F_Rds = Worksheets("Berechnung").Cells(78, 6).Value

                ufmSeilberechnung.Label34.Caption = F_Rds
                ufmSeilberechnung.Label36.Caption = F_Sds
```

```
            If F_Sds > F_Rds Then
                ufmSeilberechnung.Label35.Caption = "<"
                ufmSeilberechnung.Label33.Caption = "<"
                ufmSeilberechnung.Label34.ForeColor = &HFF&
                ufmSeilberechnung.Label35.ForeColor = &HFF&
                ufmSeilberechnung.Label36.ForeColor = &HFF&
            Else
                ufmSeilberechnung.Label35.Caption = ">"
                ufmSeilberechnung.Label33.Caption = ">"
                ufmSeilberechnung.Label34.ForeColor = &H80000012
                ufmSeilberechnung.Label35.ForeColor = &H80000012
                ufmSeilberechnung.Label36.ForeColor = &H80000012
            End If
        End If
    End If
Next i

End Sub

Public Sub Seilberechnung_CEN13001_betriebsfest()

    Dim F_Sdf As Double
    Dim F_Rdf As Double
    Dim i As Integer
    Dim a As Integer

    a = 0

    For i = 11 To 19
        If ufmSeilberechnung.Controls("TextBox" & i).Value <> "" Then
            a = a + 1
            If ufmSeilberechnung.ComboBox1.Value <> "" And ufmSeilberechnung.ComboBox2.Value <> "" And ufmSeilberechnung.ComboBox3.Value <> "" And a = 9 And ufmSeilberechnung.TextBox2.Value <> "" And ufmSeilberechnung.TextBox3.Value <> "" Then
                F_Sdf = Worksheets("Berechnung").Cells(81, 6).Value
                F_Rdf = Worksheets("Berechnung").Cells(82, 6).Value

                ufmSeilberechnung.Label79.Caption = F_Rdf
                ufmSeilberechnung.Label81.Caption = F_Sdf
                If F_Sdf > F_Rdf Then
```

```
                ufmSeilberechnung.Label80.Caption = "<"
                ufmSeilberechnung.Label78.Caption = "<"
                ufmSeilberechnung.Label79.ForeColor = &HFF&
                ufmSeilberechnung.Label81.ForeColor = &HFF&
                ufmSeilberechnung.Label80.ForeColor = &HFF&
            Else
                ufmSeilberechnung.Label80.Caption = ">"
                ufmSeilberechnung.Label78.Caption = ">"
                ufmSeilberechnung.Label79.ForeColor = &H80000012
                ufmSeilberechnung.Label81.ForeColor = &H80000012
                ufmSeilberechnung.Label80.ForeColor = &H80000012
            End If
        End If
    End If
Next i

End Sub

Public Sub betriebsfest_ff1()

    If ufmSeilberechnung.TextBox15.Value <> "" And ufmSeilberechnung.TextBox16.Value <> ""
Then
        ufmSeilberechnung.Label61.Caption = CDbl(Worksheets("Berechnung").Cells(79, 6).Text)
        If Worksheets("Berechnung").Cells(79, 6).Value < 0.75 Then
            ufmSeilberechnung.Label62.Caption = "<"
            ufmSeilberechnung.Label60.Caption = "<"
            ufmSeilberechnung.Label61.ForeColor = &HFF&
            ufmSeilberechnung.Label62.ForeColor = &HFF&
            ufmSeilberechnung.Label63.ForeColor = &HFF&
        Else
            ufmSeilberechnung.Label60.Caption = ">"
            ufmSeilberechnung.Label62.Caption = ">"
            ufmSeilberechnung.Label61.ForeColor = &H80000012
            ufmSeilberechnung.Label62.ForeColor = &H80000012
            ufmSeilberechnung.Label63.ForeColor = &H80000012
        End If
    End If

End Sub
```

```
Public Sub interpolieren_ff3()

    Dim i As Integer
    Dim Winkel As Double
    Dim x1 As Double
    Dim x2 As Double
    Dim y1 As Double
    Dim y2 As Double
    Dim k As Double
    Dim d As Double
    Dim ff3 As Double

    Winkel = CDbl(Worksheets("Berechnung").Cells(66, 2).Value)

    If Winkel < 0.5 Then
        Worksheets("Berechnung").Cells(102, 18).Value = 1
        GoTo ende
    End If
    If Winkel > 4 Then
        MsgBox "Wert darf 4° nicht übersteigen", , Error
        GoTo ende
    End If

    'Werte einlesen
    For i = 2 To Worksheets("CEN 13001").Cells(65536, 11).End(xlUp).Row
        If Winkel >= Worksheets("CEN 13001").Cells(i, 11).Value Then
            x1 = Worksheets("CEN 13001").Cells(i, 11).Value
            x2 = Worksheets("CEN 13001").Cells(i + 1, 11).Value
            y1 = Worksheets("CEN 13001").Cells(i, 12).Value
            y2 = Worksheets("CEN 13001").Cells(i + 1, 12).Value
        End If
    Next i

    k = (y2 - y1) / (x2 - x1)
    d = y1 - k * x1

    ff3 = Winkel * k + d
    Worksheets("Berechnung").Cells(102, 18).Value = ff3
```

```
ende:
End Sub

Public Sub interpolieren_ff6()

    Dim i As Integer
    Dim Seildurchmesser As Double
    Dim Rillenradius As Double
    Dim Verhältnis As Double
    Dim x1 As Double
    Dim x2 As Double
    Dim y1 As Double
    Dim y2 As Double
    Dim k As Double
    Dim d As Double
    Dim ff6 As Double

    Seildurchmesser = CDbl(Worksheets("Berechnung").Cells(13, 2).Value)
    Rillenradius = CDbl(Worksheets("Berechnung").Cells(80, 6).Value)

    Verhältnis = Rillenradius / Seildurchmesser

    If Verhältnis < 0.53 Then
        Worksheets("Berechnung").Cells(106, 18).Value = 1
        GoTo ende
    End If
    If Verhältnis > 1 Then
        Worksheets("Berechnung").Cells(106, 18).Value = 0.54
        GoTo ende
    End If

    'Werte einlesen
    For i = 2 To Worksheets("CEN 13001").Cells(65536, 14).End(xlUp).Row
        If Verhältnis >= Worksheets("CEN 13001").Cells(i, 14).Value Then
            x1 = Worksheets("CEN 13001").Cells(i, 14).Value
            x2 = Worksheets("CEN 13001").Cells(i + 1, 14).Value
            y1 = Worksheets("CEN 13001").Cells(i, 15).Value
            y2 = Worksheets("CEN 13001").Cells(i + 1, 15).Value
```

```
        End If
    Next i

    k = (y2 - y1) / (x2 - x1)
    d = y1 - k * x1

    ff6 = Verhältnis * k + d
    Worksheets("Berechnung").Cells(106, 18).Value = ff6



ende:
End Sub

Public Sub interpolieren_phi_kappa()

    Dim i As Integer
    Dim Kappa As Double
    Dim x1 As Double
    Dim x2 As Double
    Dim y1 As Double
    Dim y2 As Double
    Dim k As Double
    Dim d As Double
    Dim phi_kappa As Double

    On Error GoTo Handler_phi_kappa

    Kappa = CDbl(Worksheets("Berechnung").Cells(105, 10).Value)

    'Werte einlesen
    For i = 4 To Worksheets("Scheffler").Cells(65536, 1).End(xlUp).Row
        If Kappa >= Worksheets("Scheffler").Cells(i, 1).Value Then
            x1 = Worksheets("Scheffler").Cells(i, 1).Value
            x2 = Worksheets("Scheffler").Cells(i + 1, 1).Value
            y1 = Worksheets("Scheffler").Cells(i, 2).Value
            y2 = Worksheets("Scheffler").Cells(i + 1, 2).Value
        Else
            x1 = Worksheets("Scheffler").Cells(4, 1).Value
            x2 = Worksheets("Scheffler").Cells(5, 1).Value
```

```
        y1 = Worksheets("Scheffler").Cells(4, 2).Value
        y2 = Worksheets("Scheffler").Cells(5, 2).Value
      End If
    Next i

    k = (y2 - y1) / (x2 - x1)
    d = y1 - k * x1

    phi_kappa = Kappa * k + d
    Worksheets("Berechnung").Cells(107, 10).Value = phi_kappa
    Exit Sub

Handler_phi_kappa:
    MsgBox Err.Description & Chr(10) & Chr(10) & "Kappa = " & Kappa & Chr(10) & Chr(10) &
"phi_kappa gewählt = 1"
    Worksheets("Berechnung").Cells(107, 10).Value = 1

End Sub

Public Sub interpolieren_phi_s()

    Dim i As Integer
    Dim s_ds As Double
    Dim x1 As Double
    Dim x2 As Double
    Dim y1 As Double
    Dim y2 As Double
    Dim k As Double
    Dim d As Double
    Dim phi_s As Double

    On Error GoTo Handler_phi_s

    s_ds = CDbl(Worksheets("Berechnung").Cells(109, 10).Value)

    If s_ds < 1.2 Then
      'Werte einlesen
      For i = 4 To Worksheets("Scheffler").Cells(65536, 5).End(xlUp).Row
        If s_ds >= Worksheets("Scheffler").Cells(i, 5).Value Then
          x1 = Worksheets("Scheffler").Cells(i, 5).Value
```

```
            x2 = Worksheets("Scheffler").Cells(i + 1, 5).Value
            y1 = Worksheets("Scheffler").Cells(i, 6).Value
            y2 = Worksheets("Scheffler").Cells(i + 1, 6).Value
         Else
            x1 = Worksheets("Scheffler").Cells(4, 5).Value
            x2 = Worksheets("Scheffler").Cells(5, 5).Value
            y1 = Worksheets("Scheffler").Cells(4, 6).Value
            y2 = Worksheets("Scheffler").Cells(5, 6).Value
         End If
      Next i

      k = (y2 - y1) / (x2 - x1)
      d = y1 - k * x1

      phi_s = s_ds * k + d
      Worksheets("Berechnung").Cells(111, 10).Value = phi_s
   Else
      MsgBox "s_ds = " & s_ds & Chr(10) & "phi_s gewählt = 0.855"
      Worksheets("Berechnung").Cells(111, 10).Value = 0.855
   End If

   Exit Sub

Handler_phi_s:
   MsgBox Err.Description & Chr(10) & Chr(10) & "s_ds = " & s_ds & Chr(10) & Chr(10) &
"phi_s gewählt = 1"
   Worksheets("Berechnung").Cells(111, 10).Value = 1

End Sub

Public Sub interpolieren_phi_r()

   Dim i As Integer
   Dim hr_h As Double
   Dim x1 As Double
   Dim x2 As Double
   Dim y1 As Double
   Dim y2 As Double
   Dim k As Double
   Dim d As Double
```

```
    Dim phi_r As Double

    On Error GoTo Handler_phi_r

    hr_h = CDbl(Worksheets("Berechnung").Cells(85, 6).Value)

    If hr_h > 0.25 Then
        'Werte einlesen
        For i = 4 To Worksheets("Scheffler").Cells(65536, 8).End(xlUp).Row
            If hr_h >= Worksheets("Scheffler").Cells(i, 8).Value Then
                x1 = Worksheets("Scheffler").Cells(i, 8).Value
                x2 = Worksheets("Scheffler").Cells(i + 1, 8).Value
                y1 = Worksheets("Scheffler").Cells(i, 9).Value
                y2 = Worksheets("Scheffler").Cells(i + 1, 9).Value
            End If
        Next i

        k = (y2 - y1) / (x2 - x1)
        d = y1 - k * x1

        phi_r = hr_h * k + d
        Worksheets("Berechnung").Cells(101, 10).Value = phi_r
    Else
        MsgBox "hr_h = " & hr_h & Chr(10) & Chr(10) & "phi_r gewählt = 1"
        Worksheets("Berechnung").Cells(101, 10).Value = 1
    End If

    Exit Sub

Handler_phi_r:
    MsgBox Err.Description & Chr(10) & Chr(10) & "hr_h = " & hr_h & Chr(10) & Chr(10) &
"phi_r gewählt = 1"
    Worksheets("Berechnung").Cells(101, 10).Value = 1

End Sub

Public Sub interpolieren_k1()

    Dim i As Integer
    Dim ltr_d As Double
```

```
    Dim x1 As Double
    Dim x2 As Double
    Dim y1 As Double
    Dim y2 As Double
    Dim k As Double
    Dim d As Double
    Dim k1 As Double

    On Error GoTo Handler_k1

    ltr_d = CDbl(Worksheets("Passfeder").Cells(3, 13).Value)

    'Werte einlesen
    For i = 4 To Worksheets("Passfeder").Cells(65536, 8).End(xlUp).Row
        If ltr_d >= Worksheets("Passfeder").Cells(i, 8).Value Then
            x1 = Worksheets("Passfeder").Cells(i, 8).Value
            x2 = Worksheets("Passfeder").Cells(i + 1, 8).Value
            y1 = Worksheets("Passfeder").Cells(i, 9).Value
            y2 = Worksheets("Passfeder").Cells(i + 1, 9).Value
        End If
    Next i

    k = (y2 - y1) / (x2 - x1)
    d = y1 - k * x1

    k1 = ltr_d * k + d
    Worksheets("Berechnung").Cells(75, 10).Value = k1

    'Sicherheit SFS ausgeben
    ufmParametereingabe.Label212.Caption = CDbl(Worksheets("Berechnung").Cells(91, 6).Text)
    Passfederwahl

    Exit Sub

Handler_k1:
    MsgBox Err.Description & Chr(10) & Chr(10) & "l_trd = " & ltr_d & Chr(10) & Chr(10) & "k1
= 1"
    Worksheets("Berechnung").Cells(75, 10).Value = 1

End Sub
```

```
Public Sub Beanspruchungsklasse()

    Dim Klasse As String
    Dim Klasse2 As String
    Dim i As Integer
    Dim j As Integer
    Dim Lastwechsel As Double
    Dim Windungen_HAB As Double

    Klasse = ufmParametereingabe.ComboBox8.Text

    For i = 4 To Worksheets("zul. Spannungen").Cells(65536, 1).End(xlUp).Row

        'Falls die ausgewählte Klasse dem Eintrag entspricht werden die Parameter übertragen

        If Worksheets("zul. Spannungen").Cells(i, 1).Text = Klasse Then

            'Lastwechselfaktor in Berechnung eintragen
            Worksheets("Hauptteil").Cells(603, 7).Value = Worksheets("zul. Spannungen").Cells(i, 8).Value

            'Alle Werte mal 5 durch 3, da die Beanspruchung rein schwellend ist (DIN 4604)
            If ufmParametereingabe.OptionButton5.Value = True Then
                'Rohr, ungeschweißt
                Worksheets("Berechnung").Cells(6, 18).Value = Worksheets("zul. Spannungen").Cells(i, 2).Value * 5 / 3
                Worksheets("Berechnung").Cells(6, 18).Comment.Text Text:="Kommentar" & ":" & Chr(10) & "Beanspruchungsklasse " & Klasse & ", A1-Linie, schwellend"
                Worksheets("Hauptteil").Cells(585, 2).Value = "Beanspruchungskl. " & Klasse & ", A1-Linie, schwellend"
            ElseIf ufmParametereingabe.OptionButton6.Value = True Then
                'Blech B-Linie
                Worksheets("Berechnung").Cells(6, 18).Value = Worksheets("zul. Spannungen").Cells(i, 3).Value * 5 / 3
                Worksheets("Berechnung").Cells(6, 18).Comment.Text Text:="Kommentar" & ":" & Chr(10) & "Beanspruchungsklasse " & Klasse & ", B-Linie, schwellend"
                Worksheets("Hauptteil").Cells(585, 2).Value = "Beanspruchungskl. " & Klasse & ", B-Linie, schwellend"
            Else
                'Blech C-Linie
```

```
        Worksheets("Berechnung").Cells(6, 18).Value = Worksheets("zul. Spannungen").Cells(i, 4).Value * 5 / 3
        Worksheets("Berechnung").Cells(6, 18).Comment.Text Text:="Kommentar" & ":" & Chr(10) & "Beanspruchungsklasse " & Klasse & ", C-Linie, schwellend"
        Worksheets("Hauptteil").Cells(585, 2).Value = "Beanspruchungskl. " & Klasse & ", C-Linie, schwellend"
    End If


    'zul. Spannung für Trommelstirnwand
    'wenn der Hauptarbeitsbereich eingegeben ist wird dieser Wert berechnet
    If ufmSeilberechnung.TextBox11.Value <> "" And ufmSeilberechnung.TextBox12.Value <> "" And ufmParametereingabe.TextBox11.Value <> "" Then
        Windungen_HAB = Worksheets("Berechnung").Cells(87, 6).Value



        Worksheets("Hauptteil").Cells(603, 3).Value = Windungen_HAB


        Lastwechsel = Worksheets("zul. Spannungen").Cells(i, 8).Value * 2 / 3 * Windungen_HAB


        For j = 4 To Worksheets("zul. Spannungen").Cells(65536, 7).End(xlUp).Row


          If Lastwechsel > CDbl(Worksheets("zul. Spannungen").Cells(j, 8).Value) Then


            Klasse2 = Worksheets("zul. Spannungen").Cells(j + 1, 1).Value
            Worksheets("Hauptteil").Cells(616, 9).Value = Klasse2


            'A-Linie zul. Spannungen für die Berechnungen der Dicke der Trommelstirnwand
            Worksheets("Berechnung").Cells(19, 18).Value = Worksheets("zul. Spannungen").Cells(j + 1, 2).Value
            Worksheets("Berechnung").Cells(19, 18).Comment.Text Text:="Kommentar" & ":" & Chr(10) & "Beanspruchungsklasse " & Klasse2 & ", A1-Linie, wechselnd"
            Worksheets("Hauptteil").Cells(1134, 2).Value = "Beanspruchungskl. " & Klasse2 & ", A1-Linie, wechselnd"
            'F-Linie, wechselnde Belastung
            Worksheets("Berechnung").Cells(17, 18).Value = Worksheets("zul. Spannungen").Cells(j + 1, 7).Value
            Worksheets("Berechnung").Cells(17, 18).Comment.Text Text:="Kommentar" & ":" & Chr(10) & "Beanspruchungsklasse " & Klasse2 & ", F-Linie, wechselnd"
            Worksheets("Hauptteil").Cells(1058, 2).Value = "Beanspruchungskl. " & Klasse2 & ", D12-Linie, wechselnd"
            'D-Linie, wechselnde Belastung
```

```
            Worksheets("Berechnung").Cells(8, 18).Value = Worksheets("zul. Spannungen").Cells(j + 1, 5).Value
            Worksheets("Berechnung").Cells(8, 18).Comment.Text Text:="Kommentar" & ":" & Chr(10) & "Beanspruchungsklasse " & Klasse2 & ", D-Linie, wechselnd"
            Worksheets("Hauptteil").Cells(910, 2).Value = "Beanspruchungskl. " & Klasse2 & ", F-Linie, wechselnd"
            'B-Linie, wechselnde Belastung
            Worksheets("Berechnung").Cells(9, 18).Value = Worksheets("zul. Spannungen").Cells(j + 1, 3).Value
            Worksheets("Berechnung").Cells(9, 18).Comment.Text Text:="Kommentar" & ":" & Chr(10) & "Beanspruchungsklasse " & Klasse2 & ", B-Linie, wechselnd"
            Worksheets("Hauptteil").Cells(1008, 4).Value = "Beanspruchungskl. " & Klasse2 & ", wechselnd"
            Worksheets("Hauptteil").Cells(1110, 4).Value = "Beanspruchungskl. " & Klasse2 & ", wechselnd"
            'C-Linie, wechselnde, für Schweißnaht Wellenzapfen - Stirnwand
            Worksheets("Berechnung").Cells(11, 18).Value = Worksheets("zul. Spannungen").Cells(j + 1, 4).Value
            Worksheets("Berechnung").Cells(11, 18).Comment.Text Text:="Kommentar" & ":" & Chr(10) & "Beanspruchungsklasse " & Klasse2 & ", C-Linie, wechselnd"
            Worksheets("Hauptteil").Cells(783, 2).Value = "Beanspruchungskl. " & Klasse2 & ", C-Linie, wechselnd"
            'E-Linie, wechselnd, Wellenzapfen-Rippe und Rippe-Ring
            Worksheets("Berechnung").Cells(14, 18).Value = Worksheets("zul. Spannungen").Cells(j + 1, 6).Value
            Worksheets("Berechnung").Cells(14, 18).Comment.Text Text:="Kommentar" & ":" & Chr(10) & "Beanspruchungsklasse " & Klasse2 & ", E-Linie, wechselnd"


        End If
    Next j


  Else
    'Abgeschätzter Wert da kein Hauptarbeitsbereich eingegeben wurde
    Windungen_HAB = 8
    Worksheets("Hauptteil").Cells(603, 3).Value = Windungen_HAB


    Lastwechsel = Worksheets("zul. Spannungen").Cells(i, 8).Value * 2 / 3 * Windungen_HAB



    For j = 4 To Worksheets("zul. Spannungen").Cells(65536, 7).End(xlUp).Row


      If Lastwechsel > CDbl(Worksheets("zul. Spannungen").Cells(j, 8).Value) Then
```

```
Klasse2 = Worksheets("zul. Spannungen").Cells(j + 1, 1).Value
Worksheets("Hauptteil").Cells(616, 9).Value = Klasse2


'A-Linei zul. Spannungen für die Berechnungen der Dicke der Trommelstirnwand
Worksheets("Berechnung").Cells(19, 18).Value = Worksheets("zul. Spannungen").Cells(j + 1, 2).Value
Worksheets("Berechnung").Cells(19, 18).Comment.Text Text:="Kommentar" & ":" & Chr(10) & "Beanspruchungsklasse " & Klasse2 & ", A1-Linie, wechselnd, abgeschätzter Wert"
Worksheets("Hauptteil").Cells(1134, 2).Value = "Beanspruchungskl. " & Klasse2 & ", A1-Linie, wechselnd, abgeschätzter Wert"
'F-Linie, wechselnde Belastung
Worksheets("Berechnung").Cells(17, 18).Value = Worksheets("zul. Spannungen").Cells(j + 1, 7).Value
Worksheets("Berechnung").Cells(17, 18).Comment.Text Text:="Kommentar" & ":" & Chr(10) & "Beanspruchungsklasse " & Klasse2 & ", F-Linie, wechselnd, abgeschätzter Wert"
Worksheets("Hauptteil").Cells(1058, 2).Value = "Beanspruchungskl. " & Klasse2 & ", D12-Linie, wechselnd, abgeschätzter Wert"
'D-Linie, wechselnde Belastung
Worksheets("Berechnung").Cells(8, 18).Value = Worksheets("zul. Spannungen").Cells(j + 1, 5).Value
Worksheets("Berechnung").Cells(8, 18).Comment.Text Text:="Kommentar" & ":" & Chr(10) & "Beanspruchungsklasse " & Klasse2 & ", D-Linie, wechselnd, abgeschätzter Wert"
Worksheets("Hauptteil").Cells(910, 2).Value = "Beanspruchungskl. " & Klasse2 & ", F-Linie, wechselnd, abgeschätzter Wert"
'B-Linie, wechselnde Belastung
Worksheets("Berechnung").Cells(9, 18).Value = Worksheets("zul. Spannungen").Cells(j + 1, 3).Value
Worksheets("Berechnung").Cells(9, 18).Comment.Text Text:="Kommentar" & ":" & Chr(10) & "Beanspruchungsklasse " & Klasse2 & ", B-Linie, wechselnd, abgeschätzter Wert"
Worksheets("Hauptteil").Cells(1008, 4).Value = "Beanspruchungskl. " & Klasse2 & ", wechselnd, abgeschätzter Wert"
Worksheets("Hauptteil").Cells(1110, 4).Value = "Beanspruchungskl. " & Klasse2 & ", wechselnd, abgeschätzter Wert"
'C-Linie, wechselnde, für Schweißnaht Wellenzapfen - Stirnwand
Worksheets("Berechnung").Cells(11, 18).Value = Worksheets("zul. Spannungen").Cells(j + 1, 4).Value
Worksheets("Berechnung").Cells(11, 18).Comment.Text Text:="Kommentar" & ":" & Chr(10) & "Beanspruchungsklasse " & Klasse2 & ", C-Linie, wechselnd, abgeschätzter Wert"
Worksheets("Hauptteil").Cells(783, 2).Value = "Beanspruchungskl. " & Klasse2 & ", C-Linie, wechselnd, abgeschätzter Wert"
'E-Linie, wechselnd, Wellenzapfen-Rippe und Rippe-Ring
Worksheets("Berechnung").Cells(14, 18).Value = Worksheets("zul. Spannungen").Cells(j + 1, 6).Value
Worksheets("Berechnung").Cells(14, 18).Comment.Text Text:="Kommentar" & ":" & Chr(10) & "Beanspruchungsklasse " & Klasse2 & ", E-Linie, wechselnd, abgeschätzter Wert"
```

```
                End If
            Next j

        End If

    End If

Next i

'Begrenzung der zul. Spannung auf 215 N/mm²
If Worksheets("Berechnung").Cells(6, 18).Value > 215 Then
    Worksheets("Berechnung").Cells(6, 18).Value = 215
End If

If Worksheets("Berechnung").Cells(17, 18).Value > 215 Then
    Worksheets("Berechnung").Cells(17, 18).Value = 215
End If

'Falls die Lastwechsel zu groß werden, wird die zul. Spannung mit dem Minimalwert begrenzt
If Lastwechsel > CDbl(Worksheets("zul. Spannungen").Cells(12, 8).Value) Then
    Worksheets("Hauptteil").Cells(603, 3).Value = "begrenzt!"
    Worksheets("Hauptteil").Cells(616, 9).Value = "E9"

    'A-Linie zul. Spannungen für die Berechnungen der Dicke der Trommelstirnwand
    Worksheets("Berechnung").Cells(19, 18).Value = Worksheets("zul. Spannungen").Cells(12, 2).Value
    Worksheets("Berechnung").Cells(19, 18).Comment.Text Text:="Kommentar" & ":" & Chr(10) & "Beanspruchungsklasse " & Klasse2 & ", A1-Linie, wechselnd, Beanspruchungsklasse auf E9 begrenzt"
    Worksheets("Hauptteil").Cells(1134, 2).Value = "Beanspruchungskl. " & Klasse2 & ", A1-Linie, wechselnd, Beanspruchungsklasse auf E9 begrenzt"
    'F-Linie, wechselnde Belastung
    Worksheets("Berechnung").Cells(17, 18).Value = Worksheets("zul. Spannungen").Cells(12, 7)
    Worksheets("Berechnung").Cells(17, 18).Comment.Text Text:="Kommentar" & ":" & Chr(10) & "F-Linie, wechselnd, Beanspruchungsklasse auf E9 begrenzt"
    Worksheets("Hauptteil").Cells(1058, 2).Value = "Beanspruchungskl. " & Klasse2 & ", D12-Linie, wechselnd, Beanspruchungsklasse auf E9 begrenzt"
    'D-Linie, wechselnde Belastung
    Worksheets("Berechnung").Cells(8, 18).Value = Worksheets("zul. Spannungen").Cells(12, 5)
```

```
        Worksheets("Berechnung").Cells(8, 18).Comment.Text Text:="Kommentar" & ":" & Chr(10) & "D-Linie, wechselnd, Beanspruchungsklasse auf E9 begrenzt"

        Worksheets("Hauptteil").Cells(910, 2).Value = "Beanspruchungskl. " & Klasse2 & ", F-Linie, wechselnd, Beanspruchungsklasse auf E9 begrenzt"

        'B-Linie, wechselnde Belastung

        Worksheets("Berechnung").Cells(9, 18).Value = Worksheets("zul. Spannungen").Cells(12, 3)

        Worksheets("Berechnung").Cells(9, 18).Comment.Text Text:="Kommentar" & ":" & Chr(10) & "B-Linie, wechselnd, Beanspruchungsklasse auf E9 begrenzt"

        Worksheets("Hauptteil").Cells(1008, 4).Value = "Beanspruchungskl. " & Klasse2 & ", wechselnd, Beanspruchungsklasse auf E9 begrenzt"

        Worksheets("Hauptteil").Cells(1110, 4).Value = "Beanspruchungskl. " & Klasse2 & ", wechselnd, Beanspruchungsklasse auf E9 begrenzt"

        'C-Linie, wechselnde, für Schweißnaht Wellenzapfen - Stirnwand

        Worksheets("Berechnung").Cells(11, 18).Value = Worksheets("zul. Spannungen").Cells(12, 4)

        Worksheets("Berechnung").Cells(11, 18).Comment.Text Text:="Kommentar" & ":" & Chr(10) & "C-Linie, wechselnd, Beanspruchungsklasse auf E9 begrenzt"

        Worksheets("Hauptteil").Cells(783, 2).Value = "C-Linie, wechselnd, Beanspruchungsklasse auf E9 begrenzt"

        'E-Linie, wechselnd, Wellenzapfen-Rippe und Rippe-Ring

        Worksheets("Berechnung").Cells(14, 18).Value = Worksheets("zul. Spannungen").Cells(j + 1, 6).Value

        Worksheets("Berechnung").Cells(14, 18).Comment.Text Text:="Kommentar" & ":" & Chr(10) & "E-Linie, wechselnd, Beanspruchungsklasse auf E9 begrenzt"

    End If


End Sub


Public Sub Schweißnähte()


    'Aktualisieren der Schweißnahtdicken

    Dim TBNumber As Long

    Dim Kontrolvariable As Integer

    Dim i As Long

    Dim Berechnung_Pfad As String

    Dim WZN As String

    Dim RN As String


    TBNumber = 8

    Kontrolvariable = 0


    'Bilder müssen im gleichen Ordner wie die Berechnung (Exceldatei) sein

    Berechnung_Pfad = Application.ActiveWorkbook.Path
```

```
'Falls eine TextBox grün ist und ein Wert vorhanden ist wird sie auf weiß gesetzt
For i = 1 To TBNumber
    If ufmWellenzapfen.Controls("TextBox" & i).Value <> "" And ufmWellenzapfen.Controls("TextBox" & i).BackColor = &HFF00& Then
        ufmWellenzapfen.Controls("TextBox" & i).BackColor = &H80000009
    End If
Next i

For i = 1 To TBNumber
    If ufmWellenzapfen.Controls("TextBox" & i).BackColor <> &H80000009 Then
        Kontrolvariable = Kontrolvariable + 1
    End If
Next i

If ufmWellenzapfen.OptionButton1 = True Then
    If Worksheets("Berechnung").Cells(74, 2).Value * 2 < Worksheets("Berechnung").Cells(71, 2).Value Then
        Worksheets("Hauptteil").Cells(1110, 2).Value = ""
        Worksheets("Hauptteil").Cells(1110, 1).Value = "Dpl.-HY-Kehlnaht, E52-Linie"
        WZN = "HY"
    Else
        Worksheets("Hauptteil").Cells(1110, 1).Value = ""
        Worksheets("Hauptteil").Cells(1110, 2).Value = "K-Naht, D52-Linie"
        WZN = "K"
    End If

    If Worksheets("Berechnung").Cells(76, 2).Value * 2 < Worksheets("Berechnung").Cells(71, 2).Value Then
        Worksheets("Hauptteil").Cells(1008, 2).Value = ""
        Worksheets("Hauptteil").Cells(1008, 1).Value = "Dpl.-HY-Kehlnaht, E52-Linie"
        RN = "HY"
    Else
        Worksheets("Hauptteil").Cells(1008, 1).Value = ""
        Worksheets("Hauptteil").Cells(1008, 2).Value = "K-Naht, D52-Linie"
        RN = "K"
    End If

Else
    Worksheets("Hauptteil").Cells(1110, 2).Value = "Kehlnaht, F52-Linie"
```

```
        Worksheets("Hauptteil").Cells(1008, 2).Value = "Kehlnaht, F52-Linie"
        WZN = "Ke"
        RN = "Ke"
    End If

    'Laden des dementsprechenden Bildes
    Set ufmWellenzapfen.Image1.Picture = LoadPicture(Berechnung_Pfad & "\Wellenzapfen" &
"_" & WZN & "_" & RN & ".bmp")

    If Kontrolvariable > 0 Then
        MsgBox "Es sind " & Kontrolvariable & " Parameter nicht ausgefüllt!" & Chr(10) &
"Schweißnähte können nicht berechnet werden", vbOKOnly, "Error"
    Else
        ufmWellenzapfen.Label185.Caption = Worksheets("Berechnung").Cells(88, 6).Value
        ufmWellenzapfen.Label186.Caption = Worksheets("Berechnung").Cells(89, 6).Value
        ufmWellenzapfen.Label187.Caption = Worksheets("Berechnung").Cells(90, 6).Value
    End If
End Sub

Public Sub Spannungskollektiv()

    'Wert zur Berechnung von fl für Passfeder
    Dim i As Integer
    Dim a As Integer
    Dim Beanspruchungsklasse As String
    Dim Spannungskollektiv As String
    Dim Spannungsspielzahl As Double
    Dim Faktor As Double
    Dim Lastspitzen As Double

    Spannungskollektiv = ufmParametereingabe.ComboBox9.Text
    Beanspruchungsklasse = ufmParametereingabe.ComboBox8.Text

    For i = 4 To Worksheets("zul. Spannungen").Cells(65536, 18).End(xlUp).Row
        If Worksheets("zul. Spannungen").Cells(i, 18).Text = Spannungskollektiv Then
            Faktor = Worksheets("zul. Spannungen").Cells(i, 17).Value
            For a = 19 To 30
                If Worksheets("zul. Spannungen").Cells(i, a).Text = Beanspruchungsklasse Then
                    Spannungsspielzahl = Worksheets("zul. Spannungen").Cells(3, a).Value
                End If
```

```
      Next a
    End If
  Next i

  Lastspitzen = Faktor * Spannungsspielzahl
  Worksheets("zul. Spannungen").Cells(15, 20).Value = Lastspitzen

End Sub

Public Sub Seilklemmzahl()
  Dim i As Integer
  Dim x As Double
  If ufmParametereingabe.TextBox11.Value <> "" And ufmParametereingabe.ComboBox4.Value <> "" And ufmParametereingabe.TextBox17.Value <> "" And Worksheets("Tabelle1").Cells(2, 2).Text = "Bord" And ufmParametereingabe.TextBox23.Value <> "" And ufmParametereingabe.TextBox21.Value <> "" And ufmParametereingabe.TextBox22.Value <> "" Then

    For i = 1 To 100

      Worksheets("Berechnung").Cells(47, 2).Value = i
      x = CDbl(Worksheets("Berechnung").Cells(53, 18).Text)
      If CDbl(Worksheets("Berechnung").Cells(53, 18).Text) < 0 Then
        ufmParametereingabe.Label224.Caption = i
        GoTo ende
      End If
    Next i

  End If

ende:
End Sub
```

8.2.2 iLogic – Code

The following chapters are devided according to the single iLogic rules.

8.2.2.1 Welding seam at the ribs

```
If iTrigger0 = 2 then
```

```
'Deaktivieren der Windungen da diese zu erheblichen Leistungseinbußen führen können
'(werden später wieder aktiviert)
Feature.IsActive("Trommelkörper:1","Doppelwindung_KS") = false
Feature.IsActive("Trommelkörper:1","Doppelwindungen_Doppel") = false
Feature.IsActive("Trommelkörper:1","Spirale3") = true
Feature.IsActive("Trommelkörper:1","Windungen") = false


IF SNart_r = 1 then
        Feature.IsActive("Rippe:1", "Fase1") = true
        Feature.IsActive("Rippe:1", "Fase2") = true
Else
        Feature.IsActive("Rippe:1", "Fase1") = false
        Feature.IsActive("Rippe:1", "Fase2") = false
End if

'Durchlaufcheck = Durchlaufcheck +1

iTrigger0 = 3

End if
```

8.2.2.2 Drum (Part)

```
Parameter("Trommelkörper:1", "d82") = R_sr

If iTrigger0 = 3 then

If Trommelschweißnaht_tr = 1 then
        'Trommelschweißnaht_Längs
        Feature.IsActive("Trommelkörper:1","Trommelscheißnaht_Längs") = true
Else
        Feature.IsActive("Trommelkörper:1","Trommelscheißnaht_Längs") = false
End if

If Trommelart = 2 then
        'Doppelseiltrommel
        Feature.IsActive("Trommelkörper:1","Unbearb_WS_Rundung") = false
        Feature.IsActive("Trommelkörper:1","Unbearb_WS") = false
        Feature.IsActive("Trommelkörper:1","Windungen") = true
```

```
    Feature.IsActive("Trommelkörper:1","Mittenfreistich") = true
    Feature.IsActive("Trommelkörper:1","Schweißnahtfreistich_WS") = false
    Feature.IsActive("Trommelkörper:1","Schweißnahtfreistich_Doppel") = true

    IF Dunbearb_tr > D_Trommel-d_Seil then

        If Lunbearbrm_tr > 0 then
            Feature.IsActive("Trommelkörper:1","Unbearb_mitte") = true
            Feature.IsActive("Trommelkörper:1","Unbearb_mitte_Rundung") = true
        Else
            Feature.IsActive("Trommelkörper:1","Unbearb_mitte") = false
            Feature.IsActive("Trommelkörper:1","Unbearb_mitte_Rundung") = false
        End if

        If Lunbearbl_tr > 0 then
            Feature.IsActive("Trommelkörper:1","Unbearb_KS") = true
            Feature.IsActive("Trommelkörper:1","Unbearb_KS_Rundung") = true
            Feature.IsActive("Trommelkörper:1","Unbearb_doppel") = true
            Feature.IsActive("Trommelkörper:1","Unbearb_doppel_Rundung") = true
        Else
            Feature.IsActive("Trommelkörper:1","Unbearb_KS") = false
            Feature.IsActive("Trommelkörper:1","Unbearb_KS_Rundung") = false
            Feature.IsActive("Trommelkörper:1","Unbearb_doppel") = false
            Feature.IsActive("Trommelkörper:1","Unbearb_doppel_Rundung") = false
        End if

    Else
        Feature.IsActive("Trommelkörper:1","Unbearb_mitte") = false
        Feature.IsActive("Trommelkörper:1","Unbearb_mitte_Rundung") = false
        Feature.IsActive("Trommelkörper:1","Unbearb_KS") = false
        Feature.IsActive("Trommelkörper:1","Unbearb_KS_Rundung") = false
        Feature.IsActive("Trommelkörper:1","Unbearb_doppel") = false
        Feature.IsActive("Trommelkörper:1","Unbearb_doppel_Rundung") = false
    End if

    If Seilklemmart = 2 then
    'Bordscheibenklemmung

        Feature.IsActive("Trommelkörper:1","Doppelwindung_KS") = false
        Feature.IsActive("Trommelkörper:1","Doppelwindungen_Doppel") = false
        Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung1") = false
```

```
            Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung4") = false
            Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung_doppel_WS") = false
            Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung_doppel_KS") = false
            Feature.IsActive("Trommelkörper:1","Schweißnahtfeistich_TK_KS") = false
            Feature.IsActive("Trommelkörper:1","Schweißnahtfreistich_TK_WS") = false
            Feature.IsActive("Trommelkörper:1","SK11_KS") = false
            Feature.IsActive("Trommelkörper:1","SK12_KS") = false
            Feature.IsActive("Trommelkörper:1","SK21_KS") = false
            Feature.IsActive("Trommelkörper:1","SK22_KS") = false
            Feature.IsActive("Trommelkörper:1","SK31_KS") = false
            Feature.IsActive("Trommelkörper:1","SK32_KS") = false
            Feature.IsActive("Trommelkörper:1","SK11_WS") = false
            Feature.IsActive("Trommelkörper:1","SK12_WS") = false
            Feature.IsActive("Trommelkörper:1","SK21_WS") = false
            Feature.IsActive("Trommelkörper:1","SK22_WS") = false
            Feature.IsActive("Trommelkörper:1","SK31_WS") = false
            Feature.IsActive("Trommelkörper:1","SK32_WS") = false
            Feature.IsActive("Trommelkörper:1","Endklemme_KS") = false
            Feature.IsActive("Trommelkörper:1","Endklemme_WS") = false
            Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_KS") = false
            Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_WS") = false
            Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_innen_KS") = false
            Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_innen_WS") = false

            'Innenklemmen
            Feature.IsActive("Trommelkörper:1","SK_r_11") = false
            Feature.IsActive("Trommelkörper:1","SK_r_12") = false
            Feature.IsActive("Trommelkörper:1","SK_r_21") = false
            Feature.IsActive("Trommelkörper:1","SK_r_22") = false
            Feature.IsActive("Trommelkörper:1","SK_r_31") = false
            Feature.IsActive("Trommelkörper:1","SK_r_32") = false
            Feature.IsActive("Trommelkörper:1","SK_m_11") = false
            Feature.IsActive("Trommelkörper:1","SK_m_12") = false
            Feature.IsActive("Trommelkörper:1","SK_m_21") = false
            Feature.IsActive("Trommelkörper:1","SK_m_22") = false
            Feature.IsActive("Trommelkörper:1","SK_m_31") = false
            Feature.IsActive("Trommelkörper:1","SK_m_32") = false
            Feature.IsActive("Trommelkörper:1","Endklemme_r") = false
            Feature.IsActive("Trommelkörper:1","Endklemme_m") = false
      Else
      'Trommelklemmung
```

```
If Befestigung = 1 then
        'Außenklemmung

        Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung1") = false
        Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung4") = false
        Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_innen_KS") = false
        Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_innen_WS") = false
        Feature.IsActive("Trommelkörper:1","Endklemme_r") = false
        Feature.IsActive("Trommelkörper:1","Endklemme_m") = false

        If Anzahl_Seile_pro_Seite = 2 then
                Feature.IsActive("Trommelkörper:1","Doppelwindung_KS") = true
                Feature.IsActive("Trommelkörper:1","Doppelwindungen_Doppel") = true
                Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung_doppel_WS") = true
                Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung_doppel_KS") = true
                Feature.IsActive("Trommelkörper:1","Endklemme_KS") = false
                Feature.IsActive("Trommelkörper:1","Endklemme_WS") = false
                Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_KS") = true
                Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_WS") = true
        Else
                Feature.IsActive("Trommelkörper:1","Doppelwindung_KS") = false
                Feature.IsActive("Trommelkörper:1","Doppelwindungen_Doppel") = false
                Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung_doppel_WS") = false
                Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung_doppel_KS") = false
                Feature.IsActive("Trommelkörper:1","Endklemme_KS") = true
                Feature.IsActive("Trommelkörper:1","Endklemme_WS") = true
                Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_KS") = false
                Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_WS") = false
        End if

        Feature.IsActive("Trommelkörper:1","Schweißnahtfeistich_TK_KS") = true
        Feature.IsActive("Trommelkörper:1","Schweißnahtfreistich_TK_WS") = true
```

```
            Feature.IsActive("Trommelkörper:1","SK11_KS") = true
            Feature.IsActive("Trommelkörper:1","SK12_KS") = true
            Feature.IsActive("Trommelkörper:1","SK21_KS") = true
            Feature.IsActive("Trommelkörper:1","SK22_KS") = true
            Feature.IsActive("Trommelkörper:1","SK31_KS") = true
            Feature.IsActive("Trommelkörper:1","SK32_KS") = true
            Feature.IsActive("Trommelkörper:1","SK11_WS") = true
            Feature.IsActive("Trommelkörper:1","SK12_WS") = true
            Feature.IsActive("Trommelkörper:1","SK21_WS") = true
            Feature.IsActive("Trommelkörper:1","SK22_WS") = true
            Feature.IsActive("Trommelkörper:1","SK31_WS") = true
            Feature.IsActive("Trommelkörper:1","SK32_WS") = true

            'Innenklemmen
            Feature.IsActive("Trommelkörper:1","SK_r_11") = false
            Feature.IsActive("Trommelkörper:1","SK_r_12") = false
            Feature.IsActive("Trommelkörper:1","SK_r_21") = false
            Feature.IsActive("Trommelkörper:1","SK_r_22") = false
            Feature.IsActive("Trommelkörper:1","SK_r_31") = false
            Feature.IsActive("Trommelkörper:1","SK_r_32") = false
            Feature.IsActive("Trommelkörper:1","SK_m_11") = false
            Feature.IsActive("Trommelkörper:1","SK_m_12") = false
            Feature.IsActive("Trommelkörper:1","SK_m_21") = false
            Feature.IsActive("Trommelkörper:1","SK_m_22") = false
            Feature.IsActive("Trommelkörper:1","SK_m_31") = false
            Feature.IsActive("Trommelkörper:1","SK_m_32") = false

        Else
            'Innenklemmung
            Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung_doppel_WS")
= false
            Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung_doppel_KS")
= false
            Feature.IsActive("Trommelkörper:1","Endklemme_KS") = false
            Feature.IsActive("Trommelkörper:1","Endklemme_WS") = false
            Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_KS") = false
            Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_WS") = false

            If Anzahl_Seile_pro_Seite = 2 then
                Feature.IsActive("Trommelkörper:1","Doppelwindung_KS") = true
                Feature.IsActive("Trommelkörper:1","Doppelwindungen_Doppel") =
true
```

```
			Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung1") = true
			Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung4") = true
			Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_innen_KS") = true
			Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_innen_WS") = true
			Feature.IsActive("Trommelkörper:1","Endklemme_r") = false
			Feature.IsActive("Trommelkörper:1","Endklemme_m") = false

		Else
			Feature.IsActive("Trommelkörper:1","Doppelwindung_KS") = false
			Feature.IsActive("Trommelkörper:1","Doppelwindungen_Doppel") = false
			Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung1") = false
			Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung4") = false
			Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_innen_KS") = false
			Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_innen_WS") = false
			Feature.IsActive("Trommelkörper:1","Endklemme_r") = true
			Feature.IsActive("Trommelkörper:1","Endklemme_m") = true
		End if

		Feature.IsActive("Trommelkörper:1","Schweißnahtfeistich_TK_KS") = true
		Feature.IsActive("Trommelkörper:1","Schweißnahtfreistich_TK_WS") = true

		Feature.IsActive("Trommelkörper:1","SK11_KS") = false
		Feature.IsActive("Trommelkörper:1","SK12_KS") = false
		Feature.IsActive("Trommelkörper:1","SK21_KS") = false
		Feature.IsActive("Trommelkörper:1","SK22_KS") = false
		Feature.IsActive("Trommelkörper:1","SK31_KS") = false
		Feature.IsActive("Trommelkörper:1","SK32_KS") = false
		Feature.IsActive("Trommelkörper:1","SK11_WS") = false
		Feature.IsActive("Trommelkörper:1","SK12_WS") = false
		Feature.IsActive("Trommelkörper:1","SK21_WS") = false
		Feature.IsActive("Trommelkörper:1","SK22_WS") = false
		Feature.IsActive("Trommelkörper:1","SK31_WS") = false
		Feature.IsActive("Trommelkörper:1","SK32_WS") = false
```

```
                'Innenklemmen
                Feature.IsActive("Trommelkörper:1","SK_r_11") = true
                Feature.IsActive("Trommelkörper:1","SK_r_12") = true
                Feature.IsActive("Trommelkörper:1","SK_r_21") = true
                Feature.IsActive("Trommelkörper:1","SK_r_22") = true
                Feature.IsActive("Trommelkörper:1","SK_r_31") = true
                Feature.IsActive("Trommelkörper:1","SK_r_32") = true
                Feature.IsActive("Trommelkörper:1","SK_m_11") = true
                Feature.IsActive("Trommelkörper:1","SK_m_12") = true
                Feature.IsActive("Trommelkörper:1","SK_m_21") = true
                Feature.IsActive("Trommelkörper:1","SK_m_22") = true
                Feature.IsActive("Trommelkörper:1","SK_m_31") = true
                Feature.IsActive("Trommelkörper:1","SK_m_32") = true
            End if

        End if
Else
        'Einfachseiltrommel

        Feature.IsActive("Trommelkörper:1","Unbearb_doppel") = false
        Feature.IsActive("Trommelkörper:1","Unbearb_doppel_Rundung") = false
        Feature.IsActive("Trommelkörper:1","Unbearb_mitte") = false
        Feature.IsActive("Trommelkörper:1","Unbearb_mitte_Rundung") = false
        Feature.IsActive("Trommelkörper:1","Windungen") = false
        Feature.IsActive("Trommelkörper:1","Mittenfreistich") = false
        Feature.IsActive("Trommelkörper:1","Schweißnahtfreistich_WS") = true

        IF Dunbearb_tr > D_Trommel-d_Seil then

            If Lunbearbrm_tr > 0 then
                Feature.IsActive("Trommelkörper:1","Unbearb_WS") = true
                Feature.IsActive("Trommelkörper:1","Unbearb_WS_Rundung") = true
            Else
                Feature.IsActive("Trommelkörper:1","Unbearb_WS") = false
                Feature.IsActive("Trommelkörper:1","Unbearb_WS_Rundung") = false
            End if

            If Lunbearbl_tr > 0 then
                Feature.IsActive("Trommelkörper:1","Unbearb_KS") = true
                Feature.IsActive("Trommelkörper:1","Unbearb_KS_Rundung") = true
            Else
```

```
                    Feature.IsActive("Trommelkörper:1","Unbearb_KS") = false
                    Feature.IsActive("Trommelkörper:1","Unbearb_KS_Rundung") = false
                End if

        Else
                Feature.IsActive("Trommelkörper:1","Unbearb_KS") = false
                Feature.IsActive("Trommelkörper:1","Unbearb_KS_Rundung") = false
                Feature.IsActive("Trommelkörper:1","Unbearb_WS") = false
                Feature.IsActive("Trommelkörper:1","Unbearb_WS_Rundung") = false
        End if

        If Seilklemmart = 2 then
        'Bordscheibenklemmung

                Feature.IsActive("Trommelkörper:1","Schweißnahtfreistich_Doppel") = false
                Feature.IsActive("Trommelkörper:1","SK11_KS") = false
                Feature.IsActive("Trommelkörper:1","SK12_KS") = false
                Feature.IsActive("Trommelkörper:1","SK21_KS") = false
                Feature.IsActive("Trommelkörper:1","SK22_KS") = false
                Feature.IsActive("Trommelkörper:1","SK31_KS") = false
                Feature.IsActive("Trommelkörper:1","SK32_KS") = false
                Feature.IsActive("Trommelkörper:1","SK11_WS") = false
                Feature.IsActive("Trommelkörper:1","SK12_WS") = false
                Feature.IsActive("Trommelkörper:1","SK21_WS") = false
                Feature.IsActive("Trommelkörper:1","SK22_WS") = false
                Feature.IsActive("Trommelkörper:1","SK31_WS") = false
                Feature.IsActive("Trommelkörper:1","SK32_WS") = false
                Feature.IsActive("Trommelkörper:1","Endklemme_KS") = false
                Feature.IsActive("Trommelkörper:1","Endklemme_WS") = false

                'Innenklemmen
                Feature.IsActive("Trommelkörper:1","SK_r_11") = false
                Feature.IsActive("Trommelkörper:1","SK_r_12") = false
                Feature.IsActive("Trommelkörper:1","SK_r_21") = false
                Feature.IsActive("Trommelkörper:1","SK_r_22") = false
                Feature.IsActive("Trommelkörper:1","SK_r_31") = false
                Feature.IsActive("Trommelkörper:1","SK_r_32") = false
                Feature.IsActive("Trommelkörper:1","SK_m_11") = false
                Feature.IsActive("Trommelkörper:1","SK_m_12") = false
                Feature.IsActive("Trommelkörper:1","SK_m_21") = false
                Feature.IsActive("Trommelkörper:1","SK_m_22") = false
```

```
		Feature.IsActive("Trommelkörper:1","SK_m_31") = false
		Feature.IsActive("Trommelkörper:1","SK_m_32") = false
		Feature.IsActive("Trommelkörper:1","Endklemme_r") = false
		Feature.IsActive("Trommelkörper:1","Endklemme_m") = false

		'Doppelseilklemmung
		Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung1") = false
		Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung4") = false
		Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_innen_KS") = false
		Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_innen_WS") = false
		Feature.IsActive("Trommelkörper:1","Doppelwindung_KS") = false
		Feature.IsActive("Trommelkörper:1","Doppelwindungen_Doppel") = false
		Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung_doppel_WS") = false
		Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung_doppel_KS") = false
		Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_KS") = false
		Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_WS") = false

		If Befestigung = 1 then
			'Kupplungsseitig
			Feature.IsActive("Trommelkörper:1","Schweißnahtfreistich_TK_WS") = true
			Feature.IsActive("Trommelkörper:1","Schweißnahtfeistich_TK_KS") = false
		Else
			'Wellenseitig
			Feature.IsActive("Trommelkörper:1","Schweißnahtfreistich_TK_WS") = false
			Feature.IsActive("Trommelkörper:1","Schweißnahtfeistich_TK_KS") = true
		End if
	Else
		'Trommelklemmung
		Feature.IsActive("Trommelkörper:1","Doppelwindungen_Doppel") = false
		Feature.IsActive("Trommelkörper:1","Schweißnahtfreistich_Doppel") = false
		Feature.IsActive("Trommelkörper:1","Schweißnahtfeistich_TK_KS") = true
		Feature.IsActive("Trommelkörper:1","Schweißnahtfreistich_TK_WS") = true

		If Anzahl_Seile_pro_Seite = 2 then
			Feature.IsActive("Trommelkörper:1","Doppelwindung_KS") = true
		Else
			Feature.IsActive("Trommelkörper:1","Doppelwindung_KS") = false
		End if

		If Befestigung = 1 then

```

```
'Kupplungsseitig
Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung1") = false
Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_innen_WS") = false
Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_innen_KS") = false
Feature.IsActive("Trommelkörper:1","Doppelwindungen_Doppel") = false
Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_WS") = false
Feature.IsActive("Trommelkörper:1","Endklemme_r") = false
Feature.IsActive("Trommelkörper:1","Endklemme_m") = false
Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung_doppel_WS") = false
Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung_doppel_KS") = false
Feature.IsActive("Trommelkörper:1","Endklemme_WS") = false
Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_KS") = false

If Anzahl_Seile_pro_Seite = 2 then
    Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung4") = true
    Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_KS") = true
    Feature.IsActive("Trommelkörper:1","Endklemme_KS") = false
    Feature.IsActive("Trommelkörper:1","Doppelwindung_KS") = true

Else
    Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung4") = false
    Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_KS") = false
    Feature.IsActive("Trommelkörper:1","Endklemme_KS") = true
    Feature.IsActive("Trommelkörper:1","Doppelwindung_KS") = false

End if

Feature.IsActive("Trommelkörper:1","SK11_KS") = true
Feature.IsActive("Trommelkörper:1","SK12_KS") = true
Feature.IsActive("Trommelkörper:1","SK21_KS") = true
Feature.IsActive("Trommelkörper:1","SK22_KS") = true
Feature.IsActive("Trommelkörper:1","SK31_KS") = true
Feature.IsActive("Trommelkörper:1","SK32_KS") = true

Feature.IsActive("Trommelkörper:1","SK11_WS") = false
Feature.IsActive("Trommelkörper:1","SK12_WS") = false
```

```
                    Feature.IsActive("Trommelkörper:1","SK21_WS") = false
                    Feature.IsActive("Trommelkörper:1","SK22_WS") = false
                    Feature.IsActive("Trommelkörper:1","SK31_WS") = false
                    Feature.IsActive("Trommelkörper:1","SK32_WS") = false

                    'Innenklemmen
                    Feature.IsActive("Trommelkörper:1","SK_r_11") = false
                    Feature.IsActive("Trommelkörper:1","SK_r_12") = false
                    Feature.IsActive("Trommelkörper:1","SK_r_21") = false
                    Feature.IsActive("Trommelkörper:1","SK_r_22") = false
                    Feature.IsActive("Trommelkörper:1","SK_r_31") = false
                    Feature.IsActive("Trommelkörper:1","SK_r_32") = false
                    Feature.IsActive("Trommelkörper:1","SK_m_11") = false
                    Feature.IsActive("Trommelkörper:1","SK_m_12") = false
                    Feature.IsActive("Trommelkörper:1","SK_m_21") = false
                    Feature.IsActive("Trommelkörper:1","SK_m_22") = false
                    Feature.IsActive("Trommelkörper:1","SK_m_31") = false
                    Feature.IsActive("Trommelkörper:1","SK_m_32") = false

            Else
            'Wellenseitig

                    Feature.IsActive("Trommelkörper:1","Endklemme_KS") = false
                    Feature.IsActive("Trommelkörper:1","Endklemme_WS") = false
                    Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_KS") = true
                    Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_WS") = true
                    Feature.IsActive("Trommelkörper:1","Endklemme_m") = false
                    Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung4") = false
                    Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_innen_WS") =
false
                    Feature.IsActive("Trommelkörper:1","Doppelwindungen_Doppel") = false
                    Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung_doppel_WS")
= false
                    Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung_doppel_KS")
= false

                    If Anzahl_Seile_pro_Seite = 2 then
                            Fea-
ture.IsActive("Trommelkörper:1","Endklemme_Doppel_innen_KS") = true
                            Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung1") =
true
                            Feature.IsActive("Trommelkörper:1","Doppelwindung_KS") = true
                            Feature.IsActive("Trommelkörper:1","Endklemme_r") = false
```

```
            Else
                Feature.IsActive("Trommelkörper:1","Rechteckige Anordnung1") = false
                Feature.IsActive("Trommelkörper:1","Endklemme_Doppel_innen_KS") = false
                Feature.IsActive("Trommelkörper:1","Endklemme_r") = true
                Feature.IsActive("Trommelkörper:1","Doppelwindung_KS") = false

            End if

            Feature.IsActive("Trommelkörper:1","SK11_WS") = false
            Feature.IsActive("Trommelkörper:1","SK12_WS") = false
            Feature.IsActive("Trommelkörper:1","SK21_WS") = false
            Feature.IsActive("Trommelkörper:1","SK22_WS") = false
            Feature.IsActive("Trommelkörper:1","SK31_WS") = false
            Feature.IsActive("Trommelkörper:1","SK32_WS") = false

            Feature.IsActive("Trommelkörper:1","SK11_KS") = false
            Feature.IsActive("Trommelkörper:1","SK12_KS") = false
            Feature.IsActive("Trommelkörper:1","SK21_KS") = false
            Feature.IsActive("Trommelkörper:1","SK22_KS") = false
            Feature.IsActive("Trommelkörper:1","SK31_KS") = false
            Feature.IsActive("Trommelkörper:1","SK32_KS") = false

            'Innenklemmen
            Feature.IsActive("Trommelkörper:1","SK_r_11") = true
            Feature.IsActive("Trommelkörper:1","SK_r_12") = true
            Feature.IsActive("Trommelkörper:1","SK_r_21") = true
            Feature.IsActive("Trommelkörper:1","SK_r_22") = true
            Feature.IsActive("Trommelkörper:1","SK_r_31") = true
            Feature.IsActive("Trommelkörper:1","SK_r_32") = true

            Feature.IsActive("Trommelkörper:1","SK_m_11") = false
            Feature.IsActive("Trommelkörper:1","SK_m_12") = false
            Feature.IsActive("Trommelkörper:1","SK_m_21") = false
            Feature.IsActive("Trommelkörper:1","SK_m_22") = false
            Feature.IsActive("Trommelkörper:1","SK_m_31") = false
            Feature.IsActive("Trommelkörper:1","SK_m_32") = false

        End if
    End if
```

```
End if

'Radius für unbearbeitetes Trommelstück
If (Dunbearb_tr-D_Trommel+d_Seil)/2<R_sr then
        Parameter("Trommelkörper:1", "d82") = (Dunbearb_tr-D_Trommel+d_Seil)/2
        Parameter("Trommelkörper:1", "d88") = (Dunbearb_tr-D_Trommel+d_Seil)/2
        Parameter("Trommelkörper:1", "d91") = (Dunbearb_tr-D_Trommel+d_Seil)/2
        Parameter("Trommelkörper:1", "d93") = (Dunbearb_tr-D_Trommel+d_Seil)/2
Else
        Parameter("Trommelkörper:1", "d82") = R_sr
        Parameter("Trommelkörper:1", "d88") = R_sr
        Parameter("Trommelkörper:1", "d91") = R_sr
        Parameter("Trommelkörper:1", "d93") = R_sr
End if

iTrigger0 = 4
End if
```

8.2.2.3 Coupling – sided flanged wheel (Part)

```
If iTrigger0 = 4 then

If Trommelart = 2 then
        If Seilklemmart = 2 then
                Feature.IsActive("Bordscheibe_Kupplungsseitig:1","Extrusion2") = true
                Feature.IsActive("Bordscheibe_Kupplungsseitig:1","Runde Anordnung3") = true
        Else
                Feature.IsActive("Bordscheibe_Kupplungsseitig:1","Extrusion2") = false
                Feature.IsActive("Bordscheibe_Kupplungsseitig:1","Runde Anordnung3") = false
        End if
Else
        If Seilklemmart = 2 then
                If Befestigung = 1 then
                        Feature.IsActive("Bordscheibe_Kupplungsseitig:1","Extrusion2") = true
                        Feature.IsActive("Bordscheibe_Kupplungsseitig:1","Runde   Anordnung3")   =
true
                Else
                        Feature.IsActive("Bordscheibe_Kupplungsseitig:1","Extrusion2") = false
                        Feature.IsActive("Bordscheibe_Kupplungsseitig:1","Runde   Anordnung3")   =
false
                End if
        Else
```

```
                Feature.IsActive("Bordscheibe_Kupplungsseitig:1","Extrusion2") = false
                Feature.IsActive("Bordscheibe_Kupplungsseitig:1","Runde Anordnung3") = false
        End if
End if

iTrigger0=5

End if
```

8.2.2.4 Shaft – sided flanged wheel (Part)

```
If iTrigger0 = 4 then

If Trommelart = 2 then
        If Seilklemmart = 2 then
                Feature.IsActive("Bordscheibe_Kupplungsseitig:1","Extrusion2") = true
                Feature.IsActive("Bordscheibe_Kupplungsseitig:1","Runde Anordnung3") = true
        Else
                Feature.IsActive("Bordscheibe_Kupplungsseitig:1","Extrusion2") = false
                Feature.IsActive("Bordscheibe_Kupplungsseitig:1","Runde Anordnung3") = false
        End if
Else
        If Seilklemmart = 2 then
                If Befestigung = 1 then
                        Feature.IsActive("Bordscheibe_Kupplungsseitig:1","Extrusion2") = true
                        Feature.IsActive("Bordscheibe_Kupplungsseitig:1","Runde  Anordnung3")  =
true
                Else
                        Feature.IsActive("Bordscheibe_Kupplungsseitig:1","Extrusion2") = false
                        Feature.IsActive("Bordscheibe_Kupplungsseitig:1","Runde  Anordnung3")  =
false
                End if
        Else
                Feature.IsActive("Bordscheibe_Kupplungsseitig:1","Extrusion2") = false
                Feature.IsActive("Bordscheibe_Kupplungsseitig:1","Runde Anordnung3") = false
        End if
End if

iTrigger0=5

End if
```

8.2.2.5 Drum clamping

```
If iTrigger0 = 6 then

If Trommelart = 2 then
        'Doppelseiltrommel

        If Seilklemmart = 2 then
        'Bordscheibenklemmung

                'Doppelseilklemmung_außen_false
                d253 = 1
                d247 = 1
                d282 = 1
                d276 = 1
                Constraint.IsActive("Tangential:4") = false
                Constraint.IsActive("Tangential:6") = false
                Constraint.IsActive("Tangential:7") = false

                'Endklemmen für Doppelseil außen
                Component.IsActive("Seilklemme_doppel:1") = false
                Component.IsActive("Seilklemme_doppel:2") = false
                Constraint.IsActive("Passend:119") = false
                Component.IsActive("Seilklemmschrauben:65") = false
                Component.IsActive("Seilklemmschrauben:66") = false
                Component.IsActive("Seilklemmschrauben:67") = false
                Component.IsActive("Seilklemmschrauben:68") = false

                'Endklemmen für Doppelseil innen
                Component.IsActive("Seilklemme_doppel:3") = false
                Component.IsActive("Seilklemme_doppel:4") = false
                Constraint.IsActive("Passend:129") = false
                Constraint.IsActive("Passend:130") = false
                Component.IsActive("Seilklemmschrauben:81") = false
                Component.IsActive("Seilklemmschrauben:82") = false
                Component.IsActive("Seilklemmschrauben:83") = false
                Component.IsActive("Seilklemmschrauben:84") = false

                'Außenklemmen
                Component.IsActive("Seilklemme_Trommel:1") = false
                Component.IsActive("Seilklemme_Trommel:2") = false
                Component.IsActive("Seilklemme_Trommel:3") = false
```

```
Component.IsActive("Endklemme:1") = false
Component.IsActive("Seilklemmschrauben:21") = false
Component.IsActive("Seilklemmschrauben:22") = false
Component.IsActive("Seilklemmschrauben:23") = false
Component.IsActive("Seilklemmschrauben:24") = false
Component.IsActive("Seilklemmschrauben:25") = false
Component.IsActive("Seilklemmschrauben:26") = false
Component.IsActive("Seilklemmschrauben:27") = false
Component.IsActive("Seilklemmschrauben:28") = false
Constraint.IsActive("Passend:3") = false
Constraint.IsActive("Passend:4") = false
Constraint.IsActive("Passend:6") = false
Constraint.IsActive("Passend:7") = false

Component.IsActive("Seilklemme_Trommel:4") = false
Component.IsActive("Seilklemme_Trommel:5") = false
Component.IsActive("Seilklemme_Trommel:6") = false
Component.IsActive("Endklemme:2") = false
Component.IsActive("Seilklemmschrauben:29") = false
Component.IsActive("Seilklemmschrauben:30") = false
Component.IsActive("Seilklemmschrauben:31") = false
Component.IsActive("Seilklemmschrauben:32") = false
Component.IsActive("Seilklemmschrauben:33") = false
Component.IsActive("Seilklemmschrauben:34") = false
Component.IsActive("Seilklemmschrauben:35") = false
Component.IsActive("Seilklemmschrauben:36") = false
Constraint.IsActive("Passend:9") = false
Constraint.IsActive("Passend:10") = false
Constraint.IsActive("Passend:12") = false
Constraint.IsActive("Passend:13") = false
Constraint.IsActive("Passend:15") = false
Constraint.IsActive("Passend:16") = false
Constraint.IsActive("Passend:17") = false
Constraint.IsActive("Passend:18") = false
Constraint.IsActive("Tangential:1") = false

'Innenklemmen
'Einfach
Component.IsActive("Seilklemme_Trommel:7") = false
Component.IsActive("Seilklemme_Trommel:8") = false
Component.IsActive("Seilklemme_Trommel:9") = false
```

```
Component.IsActive("Endklemme:3") = false
Component.IsActive("Seilklemmschrauben:37") = false
Component.IsActive("Seilklemmschrauben:38") = false
Component.IsActive("Seilklemmschrauben:39") = false
Component.IsActive("Seilklemmschrauben:40") = false
Component.IsActive("Seilklemmschrauben:41") = false
Component.IsActive("Seilklemmschrauben:42") = false
Component.IsActive("Seilklemmschrauben:43") = false
Component.IsActive("Seilklemmschrauben:44") = false
Constraint.IsActive("Passend:62") = false
Constraint.IsActive("Passend:63") = false
Constraint.IsActive("Passend:65") = false
Constraint.IsActive("Passend:66") = false
Constraint.IsActive("Passend:68") = false
Constraint.IsActive("Passend:69") = false
Constraint.IsActive("Passend:79") = false
Constraint.IsActive("Passend:80") = false
Constraint.IsActive("Tangential:2") = false

'Doppel
Component.IsActive("Seilklemme_Trommel:10") = false
Component.IsActive("Seilklemme_Trommel:11") = false
Component.IsActive("Seilklemme_Trommel:12") = false
Component.IsActive("Endklemme:4") = false
Component.IsActive("Seilklemmschrauben:45") = false
Component.IsActive("Seilklemmschrauben:46") = false
Component.IsActive("Seilklemmschrauben:47") = false
Component.IsActive("Seilklemmschrauben:48") = false
Component.IsActive("Seilklemmschrauben:49") = false
Component.IsActive("Seilklemmschrauben:50") = false
Component.IsActive("Seilklemmschrauben:51") = false
Component.IsActive("Seilklemmschrauben:52") = false
Constraint.IsActive("Passend:73") = false
Constraint.IsActive("Passend:74") = false
Constraint.IsActive("Passend:76") = false
Constraint.IsActive("Passend:75") = false
Constraint.IsActive("Passend:77") = false
Constraint.IsActive("Passend:78") = false
Constraint.IsActive("Passend:81") = false
Constraint.IsActive("Passend:82") = false
Constraint.IsActive("Fluchtend:1") = false
```

```
        Else
        'Trommelklemmung

                If Befestigung = 1 then
                        'Außenklemmung
                        Component.IsActive("Seilklemme_Trommel:1") = true
                        Component.IsActive("Seilklemme_Trommel:2") = true
                        Component.IsActive("Seilklemme_Trommel:3") = true
                        Component.IsActive("Seilklemmschrauben:21") = true
                        Component.IsActive("Seilklemmschrauben:22") = true
                        Component.IsActive("Seilklemmschrauben:23") = true
                        Component.IsActive("Seilklemmschrauben:24") = true
                        Component.IsActive("Seilklemmschrauben:25") = true
                        Component.IsActive("Seilklemmschrauben:26") = true
                        Component.IsActive("Seilklemmschrauben:27") = true
                        Component.IsActive("Seilklemmschrauben:28") = true
                        Constraint.IsActive("Passend:3") = true
                        Constraint.IsActive("Passend:4") = true
                        Constraint.IsActive("Passend:6") = true
                        Constraint.IsActive("Passend:7") = true

                        Component.IsActive("Seilklemme_Trommel:4") = true
                        Component.IsActive("Seilklemme_Trommel:5") = true
                        Component.IsActive("Seilklemme_Trommel:6") = true
                        Component.IsActive("Seilklemmschrauben:29") = true
                        Component.IsActive("Seilklemmschrauben:30") = true
                        Component.IsActive("Seilklemmschrauben:31") = true
                        Component.IsActive("Seilklemmschrauben:32") = true
                        Component.IsActive("Seilklemmschrauben:33") = true
                        Component.IsActive("Seilklemmschrauben:34") = true
                        Component.IsActive("Seilklemmschrauben:35") = true
                        Component.IsActive("Seilklemmschrauben:36") = true
                        Constraint.IsActive("Passend:9") = true
                        Constraint.IsActive("Passend:10") = true
                        Constraint.IsActive("Passend:12") = true
                        Constraint.IsActive("Passend:13") = true
                        Constraint.IsActive("Passend:15") = true
                        Constraint.IsActive("Passend:16") = true
                        Constraint.IsActive("Tangential:1") = true
```

```
'Innenklemmen
'Einfach
Component.IsActive("Seilklemme_Trommel:7") = false
Component.IsActive("Seilklemme_Trommel:8") = false
Component.IsActive("Seilklemme_Trommel:9") = false
Component.IsActive("Endklemme:3") = false
Component.IsActive("Seilklemmschrauben:37") = false
Component.IsActive("Seilklemmschrauben:38") = false
Component.IsActive("Seilklemmschrauben:39") = false
Component.IsActive("Seilklemmschrauben:40") = false
Component.IsActive("Seilklemmschrauben:41") = false
Component.IsActive("Seilklemmschrauben:42") = false
Component.IsActive("Seilklemmschrauben:43") = false
Component.IsActive("Seilklemmschrauben:44") = false
Constraint.IsActive("Passend:62") = false
Constraint.IsActive("Passend:63") = false
Constraint.IsActive("Passend:65") = false
Constraint.IsActive("Passend:66") = false
Constraint.IsActive("Passend:68") = false
Constraint.IsActive("Passend:69") = false
Constraint.IsActive("Passend:79") = false
Constraint.IsActive("Passend:80") = false
Constraint.IsActive("Tangential:2") = false

'Doppel
Component.IsActive("Seilklemme_Trommel:10") = false
Component.IsActive("Seilklemme_Trommel:11") = false
Component.IsActive("Seilklemme_Trommel:12") = false
Component.IsActive("Endklemme:4") = false
Component.IsActive("Seilklemmschrauben:45") = false
Component.IsActive("Seilklemmschrauben:46") = false
Component.IsActive("Seilklemmschrauben:47") = false
Component.IsActive("Seilklemmschrauben:48") = false
Component.IsActive("Seilklemmschrauben:49") = false
Component.IsActive("Seilklemmschrauben:50") = false
Component.IsActive("Seilklemmschrauben:51") = false
Component.IsActive("Seilklemmschrauben:52") = false
Constraint.IsActive("Passend:73") = false
Constraint.IsActive("Passend:74") = false
Constraint.IsActive("Passend:76") = false
Constraint.IsActive("Passend:75") = false
```

```
        Constraint.IsActive("Passend:77") = false
        Constraint.IsActive("Passend:78") = false
        Constraint.IsActive("Passend:81") = false
        Constraint.IsActive("Passend:82") = false
        Constraint.IsActive("Fluchtend:1") = false

        'Endklemmen für Doppelseil innen
        Component.IsActive("Seilklemme_doppel:3") = false
        Component.IsActive("Seilklemme_doppel:4") = false
        Constraint.IsActive("Passend:129") = false
        Constraint.IsActive("Passend:130") = false
        Component.IsActive("Seilklemmschrauben:81") = false
        Component.IsActive("Seilklemmschrauben:82") = false
        Component.IsActive("Seilklemmschrauben:83") = false
        Component.IsActive("Seilklemmschrauben:84") = false
        Constraint.IsActive("Tangential:7") = false
        d282 = 1
        d276 = 1

        'Endklemmen für Doppelseil
        IF Anzahl_Seile_pro_Seite = 2 then

                Component.IsActive("Seilklemme_doppel:1") = true
                Component.IsActive("Seilklemme_doppel:2") = true
                Constraint.IsActive("Passend:119") = true

                Component.IsActive("Seilklemmschrauben:65") = true
                Component.IsActive("Seilklemmschrauben:66") = true
                Component.IsActive("Seilklemmschrauben:67") = true
                Component.IsActive("Seilklemmschrauben:68") = true

                Component.IsActive("Endklemme:1") = false
                Component.IsActive("Endklemme:2") = false
                Constraint.IsActive("Passend:17") = false
                Constraint.IsActive("Passend:18") = false
                Component.IsActive("Seilklemmschrauben:24") = false
                Component.IsActive("Seilklemmschrauben:26") = false
                Component.IsActive("Seilklemmschrauben:33") = false
                Component.IsActive("Seilklemmschrauben:34") = false
                'Doppelseilklemmung_Außen_true
                d253 = 2
```

```
                d247 = 2

                Constraint.IsActive("Tangential:4") = true
                Constraint.IsActive("Tangential:6") = false

            Else

                Component.IsActive("Seilklemme_doppel:1") = false
                Component.IsActive("Seilklemme_doppel:2") = false
                Constraint.IsActive("Passend:119") = false
                Component.IsActive("Seilklemmschrauben:65") = false
                Component.IsActive("Seilklemmschrauben:66") = false
                Component.IsActive("Seilklemmschrauben:67") = false
                Component.IsActive("Seilklemmschrauben:68") = false

                Component.IsActive("Endklemme:1") = true
                Component.IsActive("Endklemme:2") = true
                Constraint.IsActive("Passend:17") = true
                Constraint.IsActive("Passend:18") = true
                Component.IsActive("Seilklemmschrauben:24") = true
                Component.IsActive("Seilklemmschrauben:26") = true
                Component.IsActive("Seilklemmschrauben:33") = true
                Component.IsActive("Seilklemmschrauben:34") = true
                'Doppelseilklemmung_Außen_false
                d253 = 1
                d247 = 1

                Constraint.IsActive("Tangential:4") = false
                Constraint.IsActive("Tangential:6") = false
            End if

        Else
            'Innenklemmung
            Component.IsActive("Seilklemme_Trommel:1") = false
            Component.IsActive("Seilklemme_Trommel:2") = false
            Component.IsActive("Seilklemme_Trommel:3") = false
            Component.IsActive("Seilklemmschrauben:21") = false
            Component.IsActive("Seilklemmschrauben:22") = false
            Component.IsActive("Seilklemmschrauben:23") = false
            Component.IsActive("Seilklemmschrauben:24") = false
            Component.IsActive("Seilklemmschrauben:25") = false
```

```
Component.IsActive("Seilklemmschrauben:26") = false
Component.IsActive("Seilklemmschrauben:27") = false
Component.IsActive("Seilklemmschrauben:28") = false
Constraint.IsActive("Passend:3") = false
Constraint.IsActive("Passend:4") = false
Constraint.IsActive("Passend:6") = false
Constraint.IsActive("Passend:7") = false

Component.IsActive("Seilklemme_Trommel:4") = false
Component.IsActive("Seilklemme_Trommel:5") = false
Component.IsActive("Seilklemme_Trommel:6") = false
Component.IsActive("Seilklemmschrauben:29") = false
Component.IsActive("Seilklemmschrauben:30") = false

Component.IsActive("Seilklemmschrauben:31") = false
Component.IsActive("Seilklemmschrauben:32") = false
Component.IsActive("Seilklemmschrauben:33") = false

Component.IsActive("Seilklemmschrauben:34") = false
Component.IsActive("Seilklemmschrauben:35") = false
Component.IsActive("Seilklemmschrauben:36") = false

Constraint.IsActive("Passend:9") = false
Constraint.IsActive("Passend:10") = false
Constraint.IsActive("Passend:12") = false
Constraint.IsActive("Passend:13") = false

Constraint.IsActive("Passend:15") = false
Constraint.IsActive("Passend:16") = false
Constraint.IsActive("Tangential:1") = false

'Innenklemmen
'Einfach
Component.IsActive("Seilklemme_Trommel:7") = true
Component.IsActive("Seilklemme_Trommel:8") = true
Component.IsActive("Seilklemme_Trommel:9") = true
Component.IsActive("Seilklemmschrauben:37") = true
Component.IsActive("Seilklemmschrauben:38") = true
Component.IsActive("Seilklemmschrauben:39") = true
Component.IsActive("Seilklemmschrauben:40") = true
Component.IsActive("Seilklemmschrauben:41") = true
```

```
            Component.IsActive("Seilklemmschrauben:42") = true

            Constraint.IsActive("Passend:62") = true
            Constraint.IsActive("Passend:63") = true
            Constraint.IsActive("Passend:65") = true
            Constraint.IsActive("Passend:66") = true
            Constraint.IsActive("Passend:68") = true
            Constraint.IsActive("Passend:69") = true


            'Doppel
            Component.IsActive("Seilklemme_Trommel:10") = true
            Component.IsActive("Seilklemme_Trommel:11") = true
            Component.IsActive("Seilklemme_Trommel:12") = true
            Component.IsActive("Seilklemmschrauben:45") = true
            Component.IsActive("Seilklemmschrauben:46") = true
            Component.IsActive("Seilklemmschrauben:47") = true
            Component.IsActive("Seilklemmschrauben:48") = true
            Component.IsActive("Seilklemmschrauben:49") = true
            Component.IsActive("Seilklemmschrauben:50") = true

            Constraint.IsActive("Passend:73") = true
            Constraint.IsActive("Passend:74") = true
            Constraint.IsActive("Passend:76") = true
            Constraint.IsActive("Passend:75") = true
            Constraint.IsActive("Passend:77") = true
            Constraint.IsActive("Passend:78") = true
            Constraint.IsActive("Fluchtend:1") = true

            'Doppelseilklemmung_Außen_false
            Component.IsActive("Endklemme:1") = false
            Component.IsActive("Endklemme:2") = false
            Constraint.IsActive("Passend:17") = false
            Constraint.IsActive("Passend:18") = false
            Component.IsActive("Seilklemmschrauben:65") = false
            Component.IsActive("Seilklemmschrauben:66") = false
            Component.IsActive("Seilklemmschrauben:67") = false
            Component.IsActive("Seilklemmschrauben:68") = false
            Component.IsActive("Seilklemme_doppel:1") = false
            Component.IsActive("Seilklemme_doppel:2") = false
            Constraint.IsActive("Passend:119") = false
```

```
        Component.IsActive("Seilklemmschrauben:24") = false
        Component.IsActive("Seilklemmschrauben:26") = false
        Component.IsActive("Seilklemmschrauben:33") = false
        Component.IsActive("Seilklemmschrauben:34") = false
        d253 = 1
        d247 = 1

        'Endklemmen für Doppelseil
        IF Anzahl_Seile_pro_Seite = 2 then

            Component.IsActive("Endklemme:3") = false
            Component.IsActive("Seilklemmschrauben:43") = false
            Component.IsActive("Seilklemmschrauben:44") = false
            Component.IsActive("Endklemme:4") = false
            Component.IsActive("Seilklemmschrauben:51") = false
            Component.IsActive("Seilklemmschrauben:52") = false
            Constraint.IsActive("Passend:81") = false
            Constraint.IsActive("Passend:82") = false
            Constraint.IsActive("Passend:80") = false
            Constraint.IsActive("Passend:79") = false
            Constraint.IsActive("Tangential:2") = false

            'Endklemmen für Doppelseil innen
            Component.IsActive("Seilklemme_doppel:3") = true
            Component.IsActive("Seilklemme_doppel:4") = true
            Constraint.IsActive("Passend:129") = true
            Constraint.IsActive("Passend:130") = true
            Component.IsActive("Seilklemmschrauben:81") = true
            Component.IsActive("Seilklemmschrauben:82") = true
            Component.IsActive("Seilklemmschrauben:83") = true
            Component.IsActive("Seilklemmschrauben:84") = true
            d282 = 2
            d276 = 2
            Constraint.IsActive("Tangential:7") = true
            Constraint.IsActive("Tangential:4") = false
            Constraint.IsActive("Tangential:6") = true

        Else
            Component.IsActive("Endklemme:3") = true
            Component.IsActive("Seilklemmschrauben:43") = true
            Component.IsActive("Seilklemmschrauben:44") = true
```

```
                Component.IsActive("Endklemme:4") = true
                Component.IsActive("Seilklemmschrauben:51") = true
                Component.IsActive("Seilklemmschrauben:52") = true
                Constraint.IsActive("Passend:81") = true
                Constraint.IsActive("Passend:82") = true
                Constraint.IsActive("Passend:80") = true
                Constraint.IsActive("Passend:79") = true
                Constraint.IsActive("Tangential:2") = true

                'Endklemmen für Doppelseil innen
                Component.IsActive("Seilklemme_doppel:3") = false
                Component.IsActive("Seilklemme_doppel:4") = false
                Constraint.IsActive("Passend:129") = false
                Constraint.IsActive("Passend:130") = false
                Component.IsActive("Seilklemmschrauben:81") = false
                Component.IsActive("Seilklemmschrauben:82") = false
                Component.IsActive("Seilklemmschrauben:83") = false
                Component.IsActive("Seilklemmschrauben:84") = false
                d282 = 1
                d276 = 1
                Constraint.IsActive("Tangential:7") = false
                Constraint.IsActive("Tangential:4") = false
                Constraint.IsActive("Tangential:6") = false

            End if

        End if

    End if
Else
    'Einfachseiltrommel
    Constraint.IsActive("Tangential:7") = false

    If Seilklemmart = 2 then
    'Bordscheibenklemmung
        Component.IsActive("Seilklemme_Trommel:1") = false
        Component.IsActive("Seilklemme_Trommel:2") = false
        Component.IsActive("Seilklemme_Trommel:3") = false
        Component.IsActive("Endklemme:1") = false
        Component.IsActive("Seilklemmschrauben:21") = false
        Component.IsActive("Seilklemmschrauben:22") = false
```

```
        Component.IsActive("Seilklemmschrauben:23") = false
        Component.IsActive("Seilklemmschrauben:24") = false
        Component.IsActive("Seilklemmschrauben:25") = false
        Component.IsActive("Seilklemmschrauben:26") = false
        Component.IsActive("Seilklemmschrauben:27") = false
        Component.IsActive("Seilklemmschrauben:28") = false
        Constraint.IsActive("Passend:3") = false
        Constraint.IsActive("Passend:4") = false
        Constraint.IsActive("Passend:6") = false
        Constraint.IsActive("Passend:7") = false

        Component.IsActive("Seilklemme_Trommel:4") = false
        Component.IsActive("Seilklemme_Trommel:5") = false
        Component.IsActive("Seilklemme_Trommel:6") = false
        Component.IsActive("Endklemme:2") = false
        Component.IsActive("Seilklemmschrauben:29") = false
        Component.IsActive("Seilklemmschrauben:30") = false
        Component.IsActive("Seilklemmschrauben:31") = false
        Component.IsActive("Seilklemmschrauben:32") = false
        Component.IsActive("Seilklemmschrauben:33") = false
        Component.IsActive("Seilklemmschrauben:34") = false
        Component.IsActive("Seilklemmschrauben:35") = false
        Component.IsActive("Seilklemmschrauben:36") = false
        Constraint.IsActive("Passend:9") = false
        Constraint.IsActive("Passend:10") = false
        Constraint.IsActive("Passend:12") = false
        Constraint.IsActive("Passend:13") = false
        Constraint.IsActive("Passend:15") = false
        Constraint.IsActive("Passend:16") = false
        Constraint.IsActive("Passend:17") = false
        Constraint.IsActive("Passend:18") = false
        Constraint.IsActive("Tangential:1") = false

        'Innenklemmen
        'Einfach
        Component.IsActive("Seilklemme_Trommel:7") = false
        Component.IsActive("Seilklemme_Trommel:8") = false
        Component.IsActive("Seilklemme_Trommel:9") = false
        Component.IsActive("Endklemme:3") = false
        Component.IsActive("Seilklemmschrauben:37") = false
        Component.IsActive("Seilklemmschrauben:38") = false
```

```
        Component.IsActive("Seilklemmschrauben:39") = false
        Component.IsActive("Seilklemmschrauben:40") = false
        Component.IsActive("Seilklemmschrauben:41") = false
        Component.IsActive("Seilklemmschrauben:42") = false
        Component.IsActive("Seilklemmschrauben:43") = false
        Component.IsActive("Seilklemmschrauben:44") = false
        Constraint.IsActive("Passend:62") = false
        Constraint.IsActive("Passend:63") = false
        Constraint.IsActive("Passend:65") = false
        Constraint.IsActive("Passend:66") = false
        Constraint.IsActive("Passend:68") = false
        Constraint.IsActive("Passend:69") = false
        Constraint.IsActive("Passend:79") = false
        Constraint.IsActive("Passend:80") = false
        Constraint.IsActive("Tangential:2") = false

        'Doppel
        Component.IsActive("Seilklemme_Trommel:10") = false
        Component.IsActive("Seilklemme_Trommel:11") = false
        Component.IsActive("Seilklemme_Trommel:12") = false
        Component.IsActive("Endklemme:4") = false
        Component.IsActive("Seilklemmschrauben:45") = false
        Component.IsActive("Seilklemmschrauben:46") = false
        Component.IsActive("Seilklemmschrauben:47") = false
        Component.IsActive("Seilklemmschrauben:48") = false
        Component.IsActive("Seilklemmschrauben:49") = false
        Component.IsActive("Seilklemmschrauben:50") = false
        Component.IsActive("Seilklemmschrauben:51") = false
        Component.IsActive("Seilklemmschrauben:52") = false
        Constraint.IsActive("Passend:73") = false
        Constraint.IsActive("Passend:74") = false
        Constraint.IsActive("Passend:76") = false
        Constraint.IsActive("Passend:75") = false
        Constraint.IsActive("Passend:77") = false
        Constraint.IsActive("Passend:78") = false
        Constraint.IsActive("Passend:81") = false
        Constraint.IsActive("Passend:82") = false
        Constraint.IsActive("Fluchtend:1") = false

    Else
        'Trommelklemmung
```

```
If Befestigung = 1 then
'Kupplungsseitig
        Component.IsActive("Seilklemme_Trommel:1") =true
        Component.IsActive("Seilklemme_Trommel:2") = true
        Component.IsActive("Seilklemme_Trommel:3") = true
        Component.IsActive("Seilklemmschrauben:21") = true
        Component.IsActive("Seilklemmschrauben:22") = true
        Component.IsActive("Seilklemmschrauben:23") = true
        Component.IsActive("Seilklemmschrauben:25") = true
        Component.IsActive("Seilklemmschrauben:27") = true
        Component.IsActive("Seilklemmschrauben:28") = true
        Constraint.IsActive("Passend:3") = true
        Constraint.IsActive("Passend:4") = true
        Constraint.IsActive("Passend:6") = true
        Constraint.IsActive("Passend:7") = true

        Component.IsActive("Seilklemme_Trommel:4") = false
        Component.IsActive("Seilklemme_Trommel:5") = false
        Component.IsActive("Seilklemme_Trommel:6") = false
        Component.IsActive("Endklemme:2") = false
        Component.IsActive("Seilklemmschrauben:29") = false
        Component.IsActive("Seilklemmschrauben:30") = false
        Component.IsActive("Seilklemmschrauben:31") = false
        Component.IsActive("Seilklemmschrauben:32") = false
        Component.IsActive("Seilklemmschrauben:33") = false
        Component.IsActive("Seilklemmschrauben:34") = false
        Component.IsActive("Seilklemmschrauben:35") = false
        Component.IsActive("Seilklemmschrauben:36") = false
        Constraint.IsActive("Passend:9") = false
        Constraint.IsActive("Passend:10") = false
        Constraint.IsActive("Passend:12") = false
        Constraint.IsActive("Passend:13") = false
        Constraint.IsActive("Passend:15") = false
        Constraint.IsActive("Passend:16") = false
        Constraint.IsActive("Passend:17") = false
        Constraint.IsActive("Passend:18") = false
        Constraint.IsActive("Tangential:1") = false

        'Innenklemmen
        'Einfach
```

```
Component.IsActive("Seilklemme_Trommel:7") = false
Component.IsActive("Seilklemme_Trommel:8") = false
Component.IsActive("Seilklemme_Trommel:9") = false
Component.IsActive("Endklemme:3") = false
Component.IsActive("Seilklemmschrauben:37") = false
Component.IsActive("Seilklemmschrauben:38") = false
Component.IsActive("Seilklemmschrauben:39") = false
Component.IsActive("Seilklemmschrauben:40") = false
Component.IsActive("Seilklemmschrauben:41") = false
Component.IsActive("Seilklemmschrauben:42") = false
Component.IsActive("Seilklemmschrauben:43") = false
Component.IsActive("Seilklemmschrauben:44") = false
Constraint.IsActive("Passend:62") = false
Constraint.IsActive("Passend:63") = false
Constraint.IsActive("Passend:65") = false
Constraint.IsActive("Passend:66") = false
Constraint.IsActive("Passend:68") = false
Constraint.IsActive("Passend:69") = false
Constraint.IsActive("Passend:79") = false
Constraint.IsActive("Passend:80") = false
Constraint.IsActive("Tangential:2") = false

'Doppel
Component.IsActive("Seilklemme_Trommel:10") = false
Component.IsActive("Seilklemme_Trommel:11") = false
Component.IsActive("Seilklemme_Trommel:12") = false
Component.IsActive("Endklemme:4") = false
Component.IsActive("Seilklemmschrauben:45") = false
Component.IsActive("Seilklemmschrauben:46") = false
Component.IsActive("Seilklemmschrauben:47") = false
Component.IsActive("Seilklemmschrauben:48") = false
Component.IsActive("Seilklemmschrauben:49") = false
Component.IsActive("Seilklemmschrauben:50") = false
Component.IsActive("Seilklemmschrauben:51") = false
Component.IsActive("Seilklemmschrauben:52") = false
Constraint.IsActive("Passend:73") = false
Constraint.IsActive("Passend:74") = false
Constraint.IsActive("Passend:76") = false
Constraint.IsActive("Passend:75") = false
Constraint.IsActive("Passend:77") = false
Constraint.IsActive("Passend:78") = false
```

```
        Constraint.IsActive("Passend:81") = false
        Constraint.IsActive("Passend:82") = false
        Constraint.IsActive("Fluchtend:1") = false

        If Anzahl_Seile_pro_Seite = 2 then
            Component.IsActive("Endklemme:1") = false
            Component.IsActive("Seilklemmschrauben:24") = false
            Component.IsActive("Seilklemmschrauben:26") = false
            d247 = 2
            Component.IsActive("Seilklemme_doppel:1") = true
            Component.IsActive("Seilklemmschrauben:65") = true
            Component.IsActive("Seilklemmschrauben:66") = true
        Else
            Component.IsActive("Endklemme:1") = true
            Component.IsActive("Seilklemmschrauben:24") = true
            Component.IsActive("Seilklemmschrauben:26") = true
            d247 = 1
            Component.IsActive("Seilklemme_doppel:1") = false
            Component.IsActive("Seilklemmschrauben:65") = false
            Component.IsActive("Seilklemmschrauben:66") = false
        End if

        Constraint.IsActive("Tangential:6") = false
        'Doppelseilklemmung_Außen_false
        Component.IsActive("Endklemme:3") = false
        Component.IsActive("Endklemme:2") = false
        Component.IsActive("Endklemme:4") = false
        Component.IsActive("Seilklemmschrauben:51") = false
        Component.IsActive("Seilklemmschrauben:52") = false
        Constraint.IsActive("Passend:129") = false
        Constraint.IsActive("Passend:81") = false
        Constraint.IsActive("Passend:82") = false
        Constraint.IsActive("Passend:80") = false
        Constraint.IsActive("Passend:79") = false
        Constraint.IsActive("Tangential:2") = false

        Constraint.IsActive("Passend:17") = false
        Constraint.IsActive("Passend:18") = false
        Component.IsActive("Seilklemmschrauben:67") = false
        Component.IsActive("Seilklemmschrauben:68") = false
        Component.IsActive("Seilklemme_doppel:2") = false
```

```
            Constraint.IsActive("Passend:119") = false
            Component.IsActive("Seilklemmschrauben:33") = false
            Component.IsActive("Seilklemmschrauben:34") = false
            d253 = 1
            d276 = 1
            d282 = 1


        Else
        'Wellenseitig
            Component.IsActive("Seilklemme_Trommel:1") =false
            Component.IsActive("Seilklemme_Trommel:2") = false
            Component.IsActive("Seilklemme_Trommel:3") = false
            Component.IsActive("Seilklemmschrauben:21") = false
            Component.IsActive("Seilklemmschrauben:22") = false
            Component.IsActive("Seilklemmschrauben:23") = false
            Component.IsActive("Seilklemmschrauben:24") = false
            Component.IsActive("Seilklemmschrauben:25") = false
            Component.IsActive("Seilklemmschrauben:26") = false
            Component.IsActive("Seilklemmschrauben:27") = false
            Component.IsActive("Seilklemmschrauben:28") = false
            Component.IsActive("Endklemme:1") = false
            Constraint.IsActive("Passend:3") = false
            Constraint.IsActive("Passend:4") = false
            Constraint.IsActive("Passend:6") = false
            Constraint.IsActive("Passend:7") = false

            Component.IsActive("Seilklemme_Trommel:4") = false
            Component.IsActive("Seilklemme_Trommel:5") = false
            Component.IsActive("Seilklemme_Trommel:6") = false
            Component.IsActive("Endklemme:2") = false
            Component.IsActive("Seilklemmschrauben:29") = false
            Component.IsActive("Seilklemmschrauben:30") = false
            Component.IsActive("Seilklemmschrauben:31") = false
            Component.IsActive("Seilklemmschrauben:32") = false
            Component.IsActive("Seilklemmschrauben:33") = false
            Component.IsActive("Seilklemmschrauben:34") = false
            Component.IsActive("Seilklemmschrauben:35") = false
            Component.IsActive("Seilklemmschrauben:36") = false
            Constraint.IsActive("Passend:9") = false
            Constraint.IsActive("Passend:10") = false
```

```
        Constraint.IsActive("Passend:12") = false
        Constraint.IsActive("Passend:13") = false
        Constraint.IsActive("Passend:15") = false
        Constraint.IsActive("Passend:16") = false
        Constraint.IsActive("Passend:17") = false
        Constraint.IsActive("Passend:18") = false
        Constraint.IsActive("Tangential:1") = false

        'Innenklemmen
        'Einfach
        If Anzahl_Seile_pro_Seite = 2 then
            Component.IsActive("Endklemme:3") = false
            Component.IsActive("Seilklemmschrauben:43") = false
            Component.IsActive("Seilklemmschrauben:44") = false
            d276 = 2
            Constraint.IsActive("Tangential:6") = true
            Component.IsActive("Seilklemme_doppel:3") = true
            Component.IsActive("Seilklemmschrauben:83") = true
            Component.IsActive("Seilklemmschrauben:84") = true
            Constraint.IsActive("Passend:129") = true
        Else
            Component.IsActive("Endklemme:3") = true
            Component.IsActive("Seilklemmschrauben:43") = true
            Component.IsActive("Seilklemmschrauben:44") = true
            d276 = 1
            Component.IsActive("Seilklemme_doppel:3") = false
            Constraint.IsActive("Tangential:6") = false
            Component.IsActive("Seilklemmschrauben:83") = false
            Component.IsActive("Seilklemmschrauben:84") = false
            Constraint.IsActive("Passend:129") = false
        End if

        'Doppelseilklemmung_Außen_false
        Component.IsActive("Endklemme:1") = false
        Component.IsActive("Endklemme:2") = false
        Component.IsActive("Endklemme:4") = false
        Component.IsActive("Seilklemmschrauben:51") = false
        Component.IsActive("Seilklemmschrauben:52") = false
        Constraint.IsActive("Passend:81") = false
        Constraint.IsActive("Passend:82") = false
        Constraint.IsActive("Passend:80") = false
```

```
Constraint.IsActive("Passend:79") = false
Constraint.IsActive("Tangential:2") = false

Constraint.IsActive("Passend:17") = false
Constraint.IsActive("Passend:18") = false
Component.IsActive("Seilklemmschrauben:65") = false
Component.IsActive("Seilklemmschrauben:66") = false
Component.IsActive("Seilklemmschrauben:67") = false
Component.IsActive("Seilklemmschrauben:68") = false
Component.IsActive("Seilklemme_doppel:1") = false
Component.IsActive("Seilklemme_doppel:2") = false
Constraint.IsActive("Passend:119") = false
Component.IsActive("Seilklemmschrauben:24") = false
Component.IsActive("Seilklemmschrauben:26") = false
Component.IsActive("Seilklemmschrauben:33") = false
Component.IsActive("Seilklemmschrauben:34") = false
d253 = 1
d247 = 1
d282 = 1

Component.IsActive("Seilklemme_doppel:4") = false
Constraint.IsActive("Passend:130") = false
Component.IsActive("Seilklemmschrauben:81") = false
Component.IsActive("Seilklemmschrauben:82") = false
Constraint.IsActive("Tangential:4") = false


Component.IsActive("Seilklemme_Trommel:7") = true
Component.IsActive("Seilklemme_Trommel:8") = true
Component.IsActive("Seilklemme_Trommel:9") = true

Component.IsActive("Seilklemmschrauben:37") = true
Component.IsActive("Seilklemmschrauben:38") = true
Component.IsActive("Seilklemmschrauben:39") = true
Component.IsActive("Seilklemmschrauben:40") = true
Component.IsActive("Seilklemmschrauben:41") = true
Component.IsActive("Seilklemmschrauben:42") = true

Constraint.IsActive("Passend:62") = true
Constraint.IsActive("Passend:63") = true
Constraint.IsActive("Passend:65") = true
```

```
                        Constraint.IsActive("Passend:66") = true
                        Constraint.IsActive("Passend:68") = true
                        Constraint.IsActive("Passend:69") = true
                        Constraint.IsActive("Passend:79") = true
                        Constraint.IsActive("Passend:80") = true
                        Constraint.IsActive("Tangential:2") = true

                        'Doppel
                        Component.IsActive("Seilklemme_Trommel:10") = false
                        Component.IsActive("Seilklemme_Trommel:11") = false
                        Component.IsActive("Seilklemme_Trommel:12") = false
                        Component.IsActive("Endklemme:4") = false
                        Component.IsActive("Seilklemmschrauben:45") = false
                        Component.IsActive("Seilklemmschrauben:46") = false
                        Component.IsActive("Seilklemmschrauben:47") = false
                        Component.IsActive("Seilklemmschrauben:48") = false
                        Component.IsActive("Seilklemmschrauben:49") = false
                        Component.IsActive("Seilklemmschrauben:50") = false
                        Component.IsActive("Seilklemmschrauben:51") = false
                        Component.IsActive("Seilklemmschrauben:52") = false
                        Constraint.IsActive("Passend:73") = false
                        Constraint.IsActive("Passend:74") = false
                        Constraint.IsActive("Passend:76") = false
                        Constraint.IsActive("Passend:75") = false
                        Constraint.IsActive("Passend:77") = false
                        Constraint.IsActive("Passend:78") = false
                        Constraint.IsActive("Passend:81") = false
                        Constraint.IsActive("Passend:82") = false
                        Constraint.IsActive("Fluchtend:1") = false

                End if
        End if
End if

iTrigger0 = 7
End if
```

8.2.2.6 Cable (Part)

```
If iTrigger0 = 7 then
```

```
If Trommelart = 2 then
        'Doppelseiltrommel
        Feature.IsActive("Seil:1","Klemmung_WS_BS_Windung") = false
        Feature.IsActive("Seil:1","Klemmung_WS_BS_Rot") = false

        If Seilklemmart = 2 then
        'Bordscheibenklemmung

                Constraint.IsActive("Tangential:4") = false
                Feature.IsActive("Seil:1","Doppel_innen_4") = false
                Feature.IsActive("Seil:1","Doppel_innen_3") = false
                Feature.IsActive("Seil:1","Doppel_innen_2") = false
                Feature.IsActive("Seil:1","Doppel_innen_1") = false

                Component.Isactive("Seil_doppel:1") = false

                Feature.IsActive("Seil:1","Umdrehung5") = false
                Feature.IsActive("Seil:1","Spirale15") = false
                Feature.IsActive("Seil:1","Spirale14") = false
                Feature.IsActive("Seil:1","Spirale13") = false

                Feature.IsActive("Seil:1","Spirale2") = true
                Feature.IsActive("Seil:1","Umdrehung1") = true
                Feature.IsActive("Seil:1","Extrusion1") = true

                Feature.IsActive("Seil:1","Umdrehung2") = false
                Feature.IsActive("Seil:1","Spirale7") = false
                Feature.IsActive("Seil:1","Spirale6") = false
                Feature.IsActive("Seil:1","Spirale5") = false
                Feature.IsActive("Seil:1","Spirale4") = false

                Feature.IsActive("Seil:1","Klemmung_WS_BK_Rot1") = false
                Feature.IsActive("Seil:1","Klemmung_WS_Extrusion") = false
                Feature.IsActive("Seil:1","Klemmung_WS_BK_W4") = false
                Feature.IsActive("Seil:1","Klemmung_WS_BK_W3") = false
                Feature.IsActive("Seil:1","Klemmung_WS_BK_W2") = false
                Feature.IsActive("Seil:1","Klemmung_WS_BK_W1") = false

        Else
        'Trommelklemmung
```

```
        If Befestigung = 1 then
            'Klemmung außen

            If Anzahl_Seile_pro_Seite = 2 then

                'Doppelseil innen passiv
                Feature.IsActive("Seil_doppel:1","Klemmung_WS_BK_W9") = false
                Feature.IsActive("Seil_doppel:1","Klemmung_WS_BK_W8") = false
                Feature.IsActive("Seil_doppel:1","Klemmung_WS_BK_W7") = false
                Feature.IsActive("Seil_doppel:1","Klemmung_WS_BK_W6") = false
                Feature.IsActive("Seil_doppel:1","Klemmung_WS_BK_W5") = false
                Feature.IsActive("Seil_doppel:1","Klemmung_WS_BK_W4") = false
                Feature.IsActive("Seil_doppel:1","Klemmung_WS_BK_W3") = false
                Feature.IsActive("Seil_doppel:1","Klemmung_WS_BK_W2") = false
                Feature.IsActive("Seil_doppel:1","Klemmung_WS_BK_W1") = false

                'Erstes Seil normal passiv
                Feature.IsActive("Seil:1","Umdrehung2") = false
                Feature.IsActive("Seil:1","Spirale7") = false
                Feature.IsActive("Seil:1","Spirale6") = false
                Feature.IsActive("Seil:1","Spirale5") = false

                'Doppelseil außen aktiv
                Feature.IsActive("Seil_doppel:1","Spirale13") = true
                Feature.IsActive("Seil_doppel:1","Spirale14") = true
                Feature.IsActive("Seil_doppel:1","Spirale15") = true
                Feature.IsActive("Seil_doppel:1","Spirale16") = true
                Feature.IsActive("Seil_doppel:1","Spirale17") = true
                Feature.IsActive("Seil_doppel:1","Umdrehung5") = true
                Feature.IsActive("Seil_doppel:1","Extrusion1") = true

                'Erstes Seil für doppelseil außen aktiv
                Feature.IsActive("Seil:1","Spirale13") = true
                Feature.IsActive("Seil:1","Spirale14") = true
                Feature.IsActive("Seil:1","Spirale15") = true
                Feature.IsActive("Seil:1","Umdrehung5") = true

                'Doppelseil aktiv
                Component.Isactive("Seil_doppel:1") = true
                Constraint.IsActive("Tangential:4") = true
            Else
```

```
                Component.Isactive("Seil_doppel:1") = false
                Constraint.IsActive("Tangential:4") = false

                Feature.IsActive("Seil:1","Umdrehung5") = false
                Feature.IsActive("Seil:1","Spirale15") = false
                Feature.IsActive("Seil:1","Spirale14") = false
                Feature.IsActive("Seil:1","Spirale13") = false

                Feature.IsActive("Seil:1","Spirale5") = true
                Feature.IsActive("Seil:1","Spirale6") = true
                Feature.IsActive("Seil:1","Spirale7") = true
                Feature.IsActive("Seil:1","Umdrehung2") = true

            End if

            Feature.IsActive("Seil:1","Spirale2") = false
            Feature.IsActive("Seil:1","Umdrehung1") = false

            Feature.IsActive("Seil:1","Spirale4") = true
            Feature.IsActive("Seil:1","Extrusion1") = true

            Feature.IsActive("Seil:1","Doppel_innen_4") = false
            Feature.IsActive("Seil:1","Doppel_innen_3") = false
            Feature.IsActive("Seil:1","Doppel_innen_2") = false
            Feature.IsActive("Seil:1","Doppel_innen_1") = false

            Feature.IsActive("Seil:1","Klemmung_WS_BK_Rot1") = false
            Feature.IsActive("Seil:1","Klemmung_WS_Extrusion") = false
            Feature.IsActive("Seil:1","Klemmung_WS_BK_W4") = false
            Feature.IsActive("Seil:1","Klemmung_WS_BK_W3") = false
            Feature.IsActive("Seil:1","Klemmung_WS_BK_W2") = false
            Feature.IsActive("Seil:1","Klemmung_WS_BK_W1") = false

        Else
            'Klemmung innen
            Feature.IsActive("Seil:1","Umdrehung5") = false
            Feature.IsActive("Seil:1","Spirale15") = false
            Feature.IsActive("Seil:1","Spirale14") = false
            Feature.IsActive("Seil:1","Spirale13") = false

            If Anzahl_Seile_pro_Seite = 2 then
```

```
'Doppelseil außen passiv
Feature.IsActive("Seil_doppel:1","Umdrehung5") = false
Feature.IsActive("Seil_doppel:1","Extrusion1") = false
Feature.IsActive("Seil_doppel:1","Spirale17") = false
Feature.IsActive("Seil_doppel:1","Spirale16") = false
Feature.IsActive("Seil_doppel:1","Spirale15") = false
Feature.IsActive("Seil_doppel:1","Spirale14") = false
Feature.IsActive("Seil_doppel:1","Spirale13") = false

Feature.IsActive("Seil:1","Klemmung_WS_BK_W4") = false
Feature.IsActive("Seil:1","Klemmung_WS_BK_W3") = false
Feature.IsActive("Seil:1","Klemmung_WS_BK_W2") = false

'Doppelseil innen aktiv
Feature.IsActive("Seil_doppel:1","Klemmung_WS_BK_W1") = true
Feature.IsActive("Seil_doppel:1","Klemmung_WS_BK_W2") = true
Feature.IsActive("Seil_doppel:1","Klemmung_WS_BK_W3") = true
Feature.IsActive("Seil_doppel:1","Klemmung_WS_BK_W4") = true
Feature.IsActive("Seil_doppel:1","Klemmung_WS_BK_W5") = true
Feature.IsActive("Seil_doppel:1","Klemmung_WS_BK_W6") = true
Feature.IsActive("Seil_doppel:1","Klemmung_WS_BK_W7") = true
Feature.IsActive("Seil_doppel:1","Klemmung_WS_BK_W8") = true
Feature.IsActive("Seil_doppel:1","Klemmung_WS_BK_W9") = true

Feature.IsActive("Seil:1","Doppel_innen_1") = true
Feature.IsActive("Seil:1","Doppel_innen_2") = true
Feature.IsActive("Seil:1","Doppel_innen_3") = true
Feature.IsActive("Seil:1","Doppel_innen_4") = true
Feature.IsActive("Seil:1","Klemmung_WS_BK_W1") = true

Component.Isactive("Seil_doppel:1") = true
Constraint.IsActive("Tangential:4") = true

Else
Component.Isactive("Seil_doppel:1") = false
Constraint.IsActive("Tangential:4") = false

Feature.IsActive("Seil:1","Doppel_innen_4") = false
Feature.IsActive("Seil:1","Doppel_innen_3") = false
Feature.IsActive("Seil:1","Doppel_innen_2") = false
```

```
                        Feature.IsActive("Seil:1","Doppel_innen_1") = false

                        Feature.IsActive("Seil:1","Klemmung_WS_BK_W2") = true
                        Feature.IsActive("Seil:1","Klemmung_WS_BK_W3") = true
                        Feature.IsActive("Seil:1","Klemmung_WS_BK_W4") = true
                        Feature.IsActive("Seil:1","Klemmung_WS_BK_Rot1") = true

                  End if

                  Feature.IsActive("Seil:1","Spirale2") = false
                  Feature.IsActive("Seil:1","Umdrehung1") = false

                  Feature.IsActive("Seil:1","Umdrehung2") = false
                  Feature.IsActive("Seil:1","Extrusion1") = false
                  Feature.IsActive("Seil:1","Spirale7") = false
                  Feature.IsActive("Seil:1","Spirale6") = false
                  Feature.IsActive("Seil:1","Spirale5") = false
                  Feature.IsActive("Seil:1","Spirale4") = false

                  Feature.IsActive("Seil:1","Klemmung_WS_BK_W1") = true
                  Feature.IsActive("Seil:1","Klemmung_WS_Extrusion") = true

            End if

      End if
Else
      'Einfachseiltrommel

      If Seilklemmart = 2 then
      'Bordscheibenklemmung
            Component.Isactive("Seil_doppel:1") = false
            Constraint.IsActive("Tangential:4") = false

            Feature.IsActive("Seil:1","Umdrehung2") = false
            Feature.IsActive("Seil:1","Spirale7") = false
            Feature.IsActive("Seil:1","Spirale6") = false
            Feature.IsActive("Seil:1","Spirale5") = false
            Feature.IsActive("Seil:1","Spirale4") = false

            Feature.IsActive("Seil:1","Klemmung_WS_BK_Rot1") = false
            Feature.IsActive("Seil:1","Klemmung_WS_BK_W4") = false
```

```
        Feature.IsActive("Seil:1","Klemmung_WS_BK_W3") = false
        Feature.IsActive("Seil:1","Klemmung_WS_BK_W2") = false
        Feature.IsActive("Seil:1","Klemmung_WS_BK_W1") = false

        If Befestigung = 1 then
            'Kupplungsseitig

            Feature.IsActive("Seil:1","Klemmung_WS_BS_Windung") = false
            Feature.IsActive("Seil:1","Klemmung_WS_BS_Rot") = false
            Feature.IsActive("Seil:1","Klemmung_WS_Extrusion") = false

            Feature.IsActive("Seil:1","Spirale2") = true
            Feature.IsActive("Seil:1","Umdrehung1") = true
            Feature.IsActive("Seil:1","Extrusion1") = true

        Else
            'Wellenseitig
            Feature.IsActive("Seil:1","Spirale2") = false
            Feature.IsActive("Seil:1","Umdrehung1") = false
            Feature.IsActive("Seil:1","Extrusion1") = false

            Feature.IsActive("Seil:1","Klemmung_WS_BS_Windung") = true
            Feature.IsActive("Seil:1","Klemmung_WS_BS_Rot") = true
            Feature.IsActive("Seil:1","Klemmung_WS_Extrusion") = true

        End if
    Else
        'Trommelklemmung
        Feature.IsActive("Seil:1","Spirale2") = false
        Feature.IsActive("Seil:1","Umdrehung1") = false
        Feature.IsActive("Seil:1","Klemmung_WS_BS_Windung") = false
        Feature.IsActive("Seil:1","Klemmung_WS_BS_Rot") = false

        If Befestigung = 1 then
            'Kupplungsseitig

            Feature.IsActive("Seil:1","Klemmung_WS_BK_Rot1") = false
            Feature.IsActive("Seil:1","Klemmung_WS_Extrusion") = false
            Feature.IsActive("Seil:1","Klemmung_WS_BK_W4") = false
            Feature.IsActive("Seil:1","Klemmung_WS_BK_W3") = false
            Feature.IsActive("Seil:1","Klemmung_WS_BK_W2") = false
```

```
            Feature.IsActive("Seil:1","Klemmung_WS_BK_W1") = false

            Feature.IsActive("Seil:1","Spirale4") = true
            Feature.IsActive("Seil:1","Extrusion1") = true

            If Anzahl_Seile_pro_Seite = 2 then
                Feature.IsActive("Seil:1","Umdrehung2") = false
                Feature.IsActive("Seil:1","Spirale7") = false
                Feature.IsActive("Seil:1","Spirale6") = false
                Feature.IsActive("Seil:1","Spirale5") = false

                Feature.IsActive("Seil:1","Spirale13") = true
                Feature.IsActive("Seil:1","Spirale14") = true
                Feature.IsActive("Seil:1","Spirale15") = true
                Feature.IsActive("Seil:1","Umdrehung5") = true

                Component.Isactive("Seil_doppel:1") = true
                Constraint.IsActive("Tangential:4") = true
            Else
                Component.Isactive("Seil_doppel:1") = false
                Constraint.IsActive("Tangential:4") = false

                Feature.IsActive("Seil:1","Umdrehung5") = false
                Feature.IsActive("Seil:1","Spirale15") = false
                Feature.IsActive("Seil:1","Spirale14") = false
                Feature.IsActive("Seil:1","Spirale13") = false

                Feature.IsActive("Seil:1","Spirale5") = true
                Feature.IsActive("Seil:1","Spirale6") = true
                Feature.IsActive("Seil:1","Spirale7") = true
                Feature.IsActive("Seil:1","Umdrehung2") = true

            End if

        Else
            'Wellenseitig
            Feature.IsActive("Seil:1","Umdrehung2") = false
            Feature.IsActive("Seil:1","Extrusion1") = false
            Feature.IsActive("Seil:1","Spirale7") = false
            Feature.IsActive("Seil:1","Spirale6") = false
            Feature.IsActive("Seil:1","Spirale5") = false
```

```
            Feature.IsActive("Seil:1","Spirale4") = false

            Feature.IsActive("Seil:1","Umdrehung5") = false
            Feature.IsActive("Seil:1","Spirale15") = false
            Feature.IsActive("Seil:1","Spirale14") = false
            Feature.IsActive("Seil:1","Spirale13") = false

            Feature.IsActive("Seil:1","Klemmung_WS_BK_W1") = true
            Feature.IsActive("Seil:1","Klemmung_WS_Extrusion") = true

            If Anzahl_Seile_pro_Seite = 2 then
                Feature.IsActive("Seil:1","Klemmung_WS_BK_Rot1") = false
                Feature.IsActive("Seil:1","Klemmung_WS_BK_W4") = false
                Feature.IsActive("Seil:1","Klemmung_WS_BK_W3") = false
                Feature.IsActive("Seil:1","Klemmung_WS_BK_W2") = false

                Feature.IsActive("Seil:1","Doppel_innen_1") = true
                Feature.IsActive("Seil:1","Doppel_innen_2") = true
                Feature.IsActive("Seil:1","Doppel_innen_3") = true
                Feature.IsActive("Seil:1","Doppel_innen_4") = true

                Component.Isactive("Seil_doppel:1") = true
                Constraint.IsActive("Tangential:4") = true

            Else
                Component.Isactive("Seil_doppel:1") = false
                Constraint.IsActive("Tangential:4") = false

                Feature.IsActive("Seil:1","Doppel_innen_4") = false
                Feature.IsActive("Seil:1","Doppel_innen_3") = false
                Feature.IsActive("Seil:1","Doppel_innen_2") = false
                Feature.IsActive("Seil:1","Doppel_innen_1") = false

                Feature.IsActive("Seil:1","Klemmung_WS_BK_W2") = true
                Feature.IsActive("Seil:1","Klemmung_WS_BK_W3") = true
                Feature.IsActive("Seil:1","Klemmung_WS_BK_W4") = true
                Feature.IsActive("Seil:1","Klemmung_WS_BK_Rot1") = true

            End if

        End if
```

```
        End if
End if

iTrigger0 = 8
End if
```

8.2.2.7 Coupling – sided flanged wheel clamping

```
If iTrigger0 = 8 then

If Trommelart = 2 then
        'Damit sich bei Innenklemmung die Bordscheibenklemmung umdreht
        d100 = Klemmwinkel_sk
        d91 = Seilklemmenzahl_sk
        d101 = Seilklemmenzahl_sk

        If Seilklemmart = 2 then
                Component.IsActive("Seilklemme_Bordscheibe:1") = true
                Component.IsActive("Seilklemmschrauben:2") = true
                Component.IsActive("Seilklemmschrauben:1") = true
                Component.IsActive("Seilklemme_Bordscheibe:2") = true
                Component.IsActive("Seilklemmschrauben:3") = true
                Component.IsActive("Seilklemmschrauben:4") = true
                Component.IsActive("Seilklemme_Bordscheibe:3") = true
                Component.IsActive("Seilklemmschrauben:5") = true
                Component.IsActive("Seilklemmschrauben:6") = true


                Component.IsActive("Seilklemme_Bordscheibe:8") = true
                Component.IsActive("Seilklemmschrauben:15") = true
                Component.IsActive("Seilklemmschrauben:16") = true
                Component.IsActive("Seilklemme_Bordscheibe:9") = true
                Component.IsActive("Seilklemmschrauben:17") = true
                Component.IsActive("Seilklemmschrauben:18") = true
                Component.IsActive("Seilklemme_Bordscheibe:10") = true
                Component.IsActive("Seilklemmschrauben:19") = true
                Component.IsActive("Seilklemmschrauben:20") = true
                Constraint.IsActive("Passend:24") = true
                Constraint.IsActive("Passend:25") = true
```

```
        Else
                Component.IsActive("Seilklemme_Bordscheibe:1") = false
                Component.IsActive("Seilklemmschrauben:2") = false
                Component.IsActive("Seilklemmschrauben:1") = false
                Component.IsActive("Seilklemme_Bordscheibe:2") = false
                Component.IsActive("Seilklemmschrauben:3") = false
                Component.IsActive("Seilklemmschrauben:4") = false
                Component.IsActive("Seilklemme_Bordscheibe:3") = false
                Component.IsActive("Seilklemmschrauben:5") = false
                Component.IsActive("Seilklemmschrauben:6") = false

                Component.IsActive("Seilklemme_Bordscheibe:8") = false
                Component.IsActive("Seilklemmschrauben:15") = false
                Component.IsActive("Seilklemmschrauben:16") = false
                Component.IsActive("Seilklemme_Bordscheibe:9") = false
                Component.IsActive("Seilklemmschrauben:17") = false
                Component.IsActive("Seilklemmschrauben:18") = false
                Component.IsActive("Seilklemme_Bordscheibe:10") = false
                Component.IsActive("Seilklemmschrauben:19") = false
                Component.IsActive("Seilklemmschrauben:20") = false
                Constraint.IsActive("Passend:24") = false
                Constraint.IsActive("Passend:25") = false

        End if
Else
        d91 = Seilklemmenzahl_sk
        d101 = Seilklemmenzahl_sk

        If Seilklemmart = 2 then
                If Befestigung = 1 then
                        d100 = Klemmwinkel_sk
                        d101 = 3
                        Component.IsActive("Seilklemme_Bordscheibe:1") = true
                        Component.IsActive("Seilklemmschrauben:2") = true
                        Component.IsActive("Seilklemmschrauben:1") = true
                        Component.IsActive("Seilklemme_Bordscheibe:2") = true
                        Component.IsActive("Seilklemmschrauben:3") = true
                        Component.IsActive("Seilklemmschrauben:4") = true
                        Component.IsActive("Seilklemme_Bordscheibe:3") = true
                        Component.IsActive("Seilklemmschrauben:5") = true
```

```
            Component.IsActive("Seilklemmschrauben:6") = true

            Component.IsActive("Seilklemme_Bordscheibe:8") = false
            Component.IsActive("Seilklemmschrauben:15") = false
            Component.IsActive("Seilklemmschrauben:16") = false
            Component.IsActive("Seilklemme_Bordscheibe:9") = false
            Component.IsActive("Seilklemmschrauben:17") = false
            Component.IsActive("Seilklemmschrauben:18") = false
            Component.IsActive("Seilklemme_Bordscheibe:10") = false
            Component.IsActive("Seilklemmschrauben:19") = false
            Component.IsActive("Seilklemmschrauben:20") = false
            Constraint.IsActive("Passend:24") = false
            Constraint.IsActive("Passend:25") = false

        Else
            'Damit sich bei Innenklemmung die Bordscheibenklemmung umdreht
            d100 = -Klemmwinkel_sk
            d91 = 3
            Component.IsActive("Seilklemme_Bordscheibe:1") = false
            Component.IsActive("Seilklemmschrauben:2") = false
            Component.IsActive("Seilklemmschrauben:1") = false
            Component.IsActive("Seilklemme_Bordscheibe:2") = false
            Component.IsActive("Seilklemmschrauben:3") = false
            Component.IsActive("Seilklemmschrauben:4") = false
            Component.IsActive("Seilklemme_Bordscheibe:3") = false
            Component.IsActive("Seilklemmschrauben:5") = false
            Component.IsActive("Seilklemmschrauben:6") = false

            Component.IsActive("Seilklemme_Bordscheibe:8") = true
            Component.IsActive("Seilklemmschrauben:15") = true
            Component.IsActive("Seilklemmschrauben:16") = true
            Component.IsActive("Seilklemme_Bordscheibe:9") = true
            Component.IsActive("Seilklemmschrauben:17") = true
            Component.IsActive("Seilklemmschrauben:18") = true
            Component.IsActive("Seilklemme_Bordscheibe:10") = true
            Component.IsActive("Seilklemmschrauben:19") = true
            Component.IsActive("Seilklemmschrauben:20") = true
            Constraint.IsActive("Passend:24") = true
            Constraint.IsActive("Passend:25") = true

        End if
```

```
        Else
                d100 = Klemmwinkel_sk
                Component.IsActive("Seilklemme_Bordscheibe:1") = false
                Component.IsActive("Seilklemmschrauben:2") = false
                Component.IsActive("Seilklemmschrauben:1") = false
                Component.IsActive("Seilklemme_Bordscheibe:2") = false
                Component.IsActive("Seilklemmschrauben:3") = false
                Component.IsActive("Seilklemmschrauben:4") = false
                Component.IsActive("Seilklemme_Bordscheibe:3") = false
                Component.IsActive("Seilklemmschrauben:5") = false
                Component.IsActive("Seilklemmschrauben:6") = false

                Component.IsActive("Seilklemme_Bordscheibe:8") = false
                Component.IsActive("Seilklemmschrauben:15") = false
                Component.IsActive("Seilklemmschrauben:16") = false
                Component.IsActive("Seilklemme_Bordscheibe:9") = false
                Component.IsActive("Seilklemmschrauben:17") = false
                Component.IsActive("Seilklemmschrauben:18") = false
                Component.IsActive("Seilklemme_Bordscheibe:10") = false
                Component.IsActive("Seilklemmschrauben:19") = false
                Component.IsActive("Seilklemmschrauben:20") = false
                Constraint.IsActive("Passend:24") = false
                Constraint.IsActive("Passend:25") = false

        End if

End if

iTrigger0 = 1
End if
```