

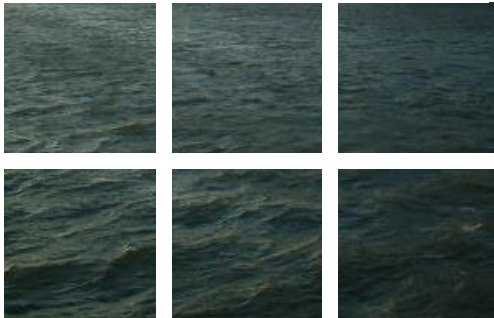
Wir machen Schifffahrt möglich.

Plastic buoys for the German coast – from nautical and economical requirements to a customer specific plastic buoy

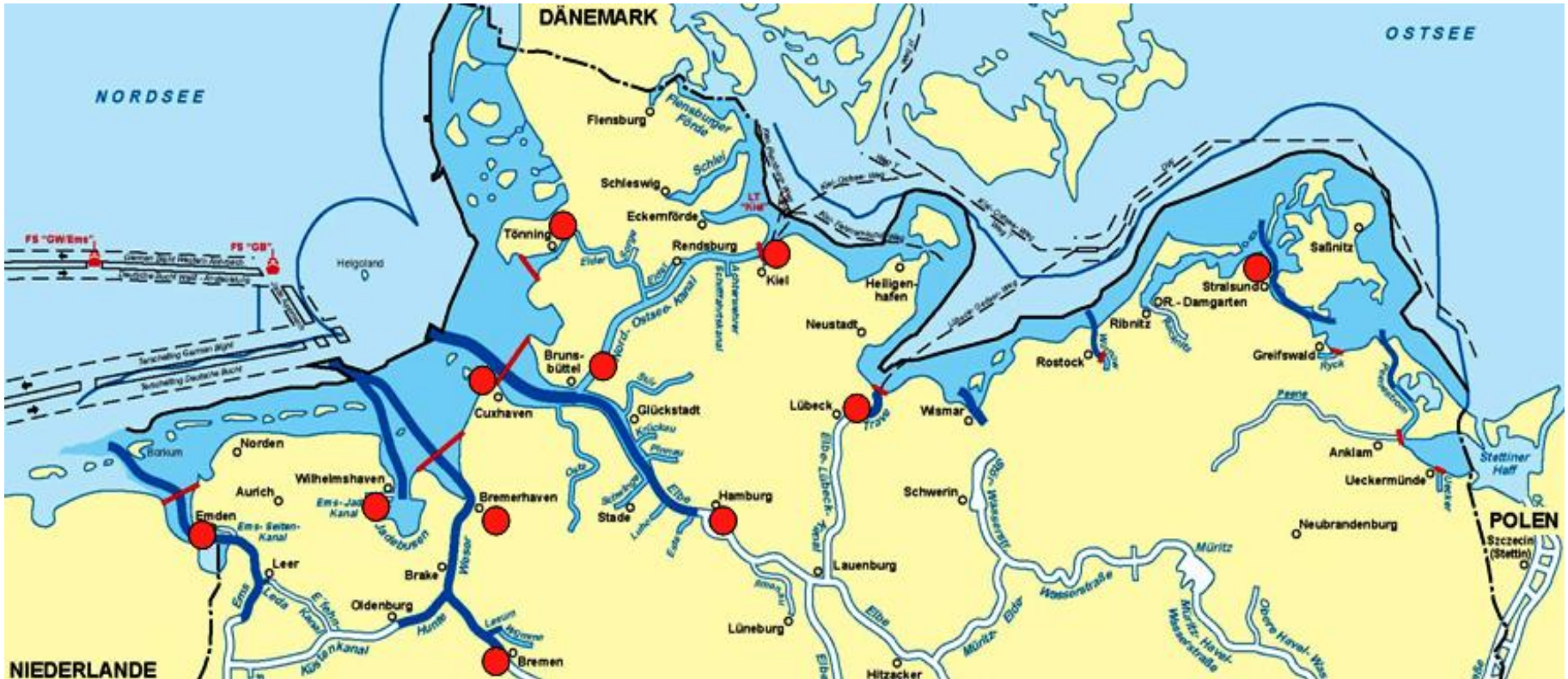


WSV.de

Wasserstraßen- und
Schifffahrtsverwaltung
des Bundes



Introduction



- The German Federal Waterways and Shipping Administration operates nearly 5.500 buoys for the North Sea and the Baltic Sea.
- These are mostly steel buoys of different classes and constructions.

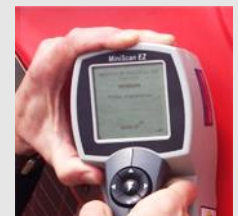
Economic calculations

- Economic calculations have shown that the conversion of small and medium-sized buoys with a diameter of less than 2.5 m from steel to plastic is economical.
- Investment volume: ~ € 30 million
- The conditions are:
 - ✓ Use of coast-wide unified buoys
 - ✓ Buoy lifetime at least 12 years
 - ✓ Possibility to use the plastic buoys in ice conditions (no special winter work)
 - ✓ No repairs during the lifetime
 - ✓ Extension of inspection intervals
 - ✓ Optimizing of the mooring systems



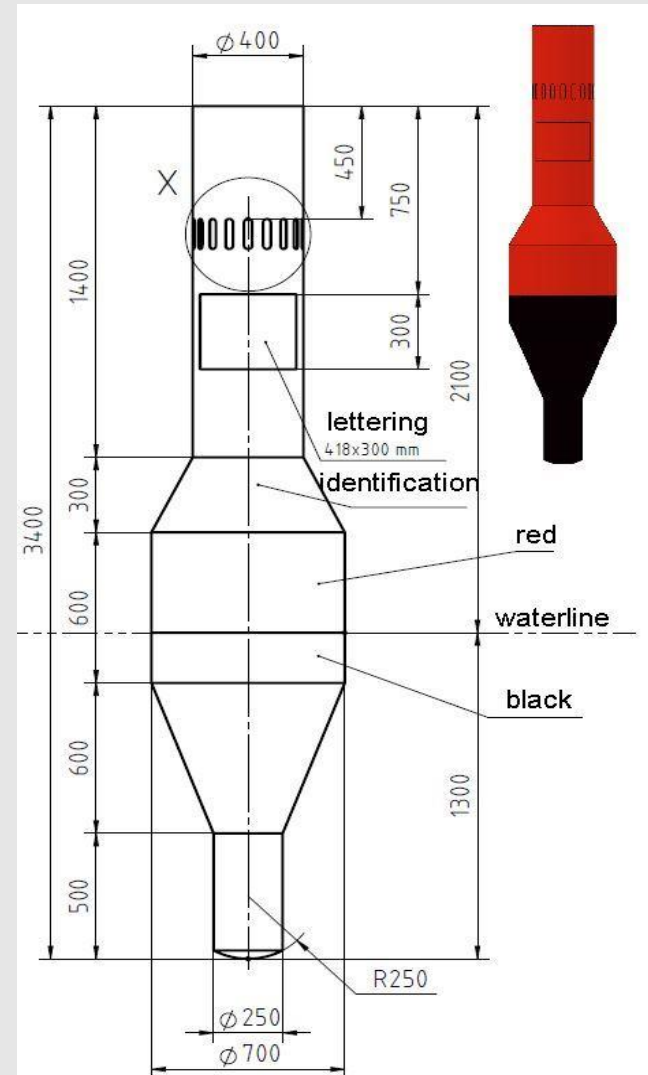
Experience with market available plastic buoys

- The German administration has tested small and medium polyethylene plastic buoys (rotational moulded) in river estuaries, the North sea and the Baltic sea.
- Tests have been carried out regarding:
 - ✓ swimming behavior (impact of current and weight of light units)
 - ✓ mooring eye wear
 - ✓ lifting eye handling
 - ✓ ice behavior (impact on buoy body and lettering)
 - ✓ plastic material- and colour-stability
 - ✓ marine growth, fouling
- Market available plastic buoys are not suitable for the use conditions of the WSV.
- Special plastic buoys according to WSV specifications must be produced.



Basics of the procurement concept

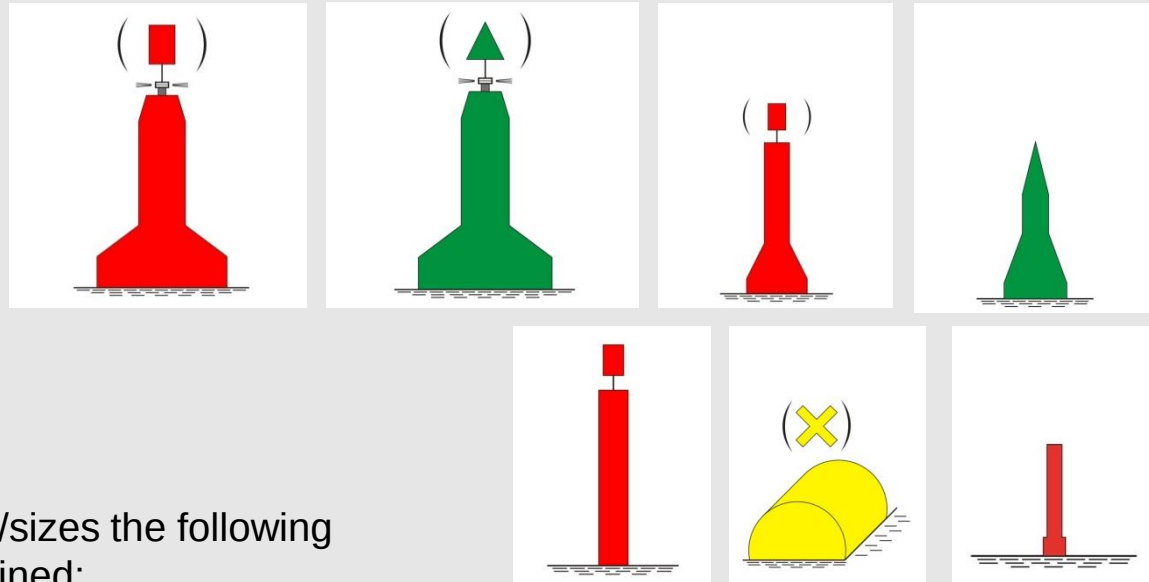
- For the fabrication of WSV-conform plastic buoys, the buoy manufacturers have to make new moulds for each buoy class/type.
- For the economic conversion to plastic buoys, a permanent competition between different buoy manufacturers is required.
- The coast-wide centralized plastic buoy procurement generates high volumes and reduces the proportionate mould costs per buoy.
- Several tenders will be carried out over the following years.



Basics of the procurement concept:

Reduction of the buoy classes, buoy classification

- For a centralized procurement of plastic buoys in large quantities the reduction of the (originally nearly 20) buoy classes to an absolutely necessary minimum was required.
- The new "buoy classification" contents 13 classes/sizes:
 - ✓ light buoys (3 sizes)
 - ✓ spar buoys (3 sizes)
 - ✓ conical buoys (3 sizes)
 - ✓ spar (1 size)
 - ✓ barrel buoys (2 sizes)
 - ✓ wadden-sea winter buoy
- For the individual buoy classes/sizes the following nautical requirements were defined:
 - ✓ day visibility (dimensions, colour and shape, top marks, lettering)
 - ✓ night visibility (light characteristics, light spot heights, retroreflective materials)
 - ✓ radio visibility (radar-reflecting capacities, RACON, AIS-AtoN)
 - ✓ floating stability
 - ✓ availability requirements
- All existing buoys had to be assigned into the new buoys classification.



Detailed technical specifications

- In addition to the nautical requirements (buoy classification) the technical specifications include special design requirements for each buoy class/size:
 - ✓ operating and environmental conditions
 - ✓ technical structure of the buoy, design features and construction, plastic wall thickness
 - ✓ rough drawings of: buoy body, lifting eye, mooring eye, radar reflector, top mark
 - ✓ mechanical strength, requirements regarding health and safety
 - ✓ requirements in case of ice occurrence
 - ✓ plastic: material, mechanical properties and their aging, colour and colour stability, welding requirements, surfaces
 - ✓ metal parts: aluminum and stainless steel (material, welding), cast iron, standard parts, torques
 - ✓ lettering, retroreflective foil, buoy identification
 - ✓ floating stability: general requirements, tilt by wind and/or current, stability calculation, ballast
 - ✓ production-accompanying tests, quality management systems, additional tests and their documentation
 - ✓ user manual (demands and content)
 - ✓ delivery and packaging requirements
 - ✓ requirements for disposal / recycling



Koblenz, 18.12.2017

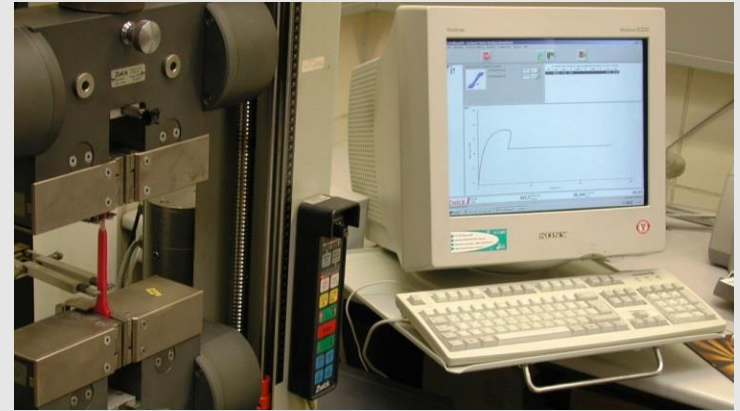
The first tender

- The preparation of the first plastic buoy tender was carried out more or less at the same time as the revision of the IALA-GUIDELINE "G 1006 on plastic buoys".
- Many ideas and contents have been incorporated into the German plastic buoy conversion project.
- To ensure the delivery of high quality plastic buoys the bidder had to provide special information / references / certificates, such as:
 - ✓ economic, financial performance and professional performance
 - ✓ proof of a quality management system
 - ✓ proof of the successful use of already delivered plastic buoys, also for use under ice conditions
 - ✓ rough drawing of the offered plastic buoys with description of the technical structure
 - ✓ proof of the ability to weld professionally plastic, aluminum and steel
 - ✓ data sheets and material certificates of the used materials and the relevant standards
 - ✓ rapid weathering tests of the plastic material (mechanical properties and colour fading)
 - ✓ rough swimming stability calculation
 - ✓ time schedule (execution phases/milestones)

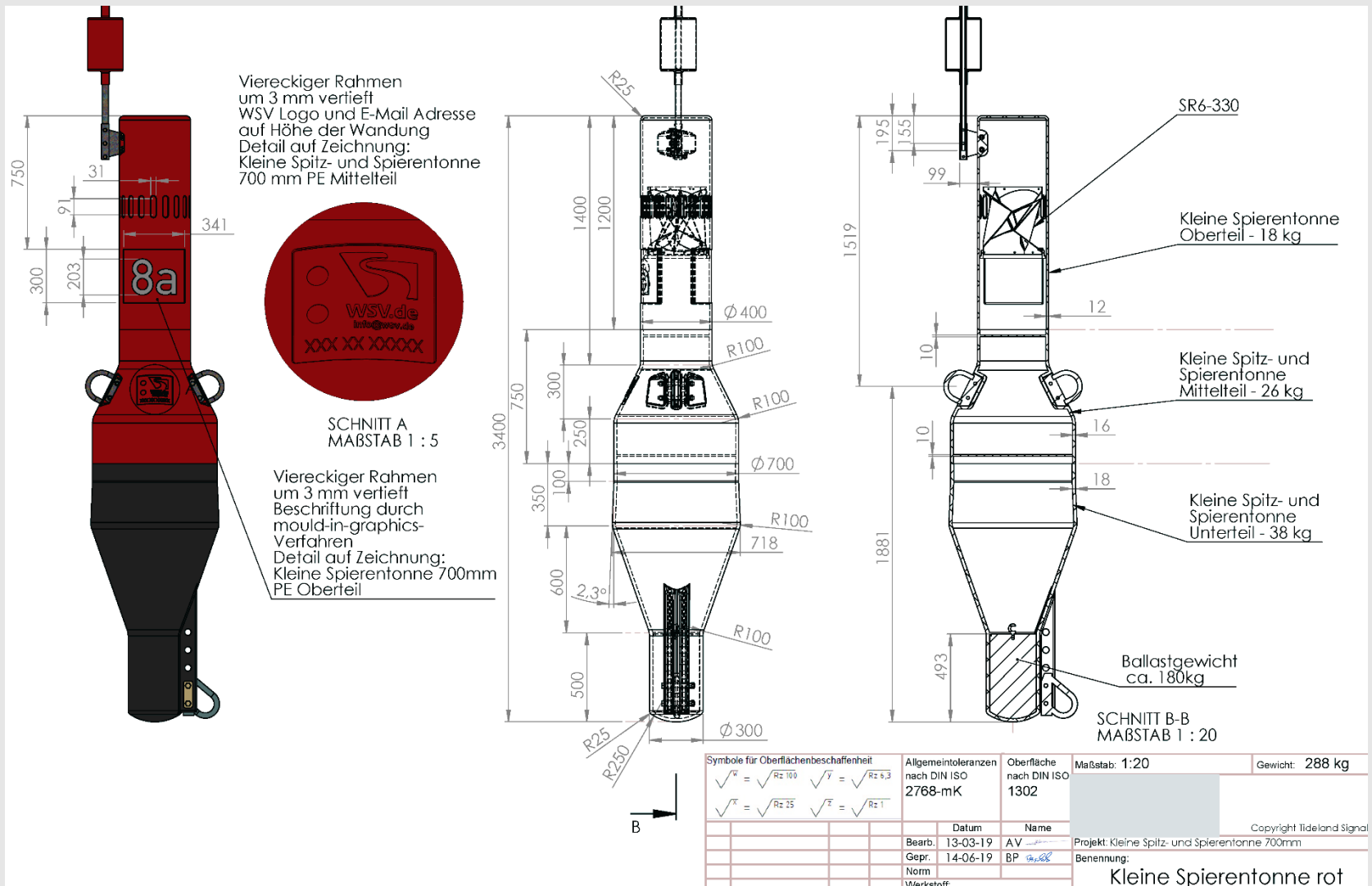


The first tender

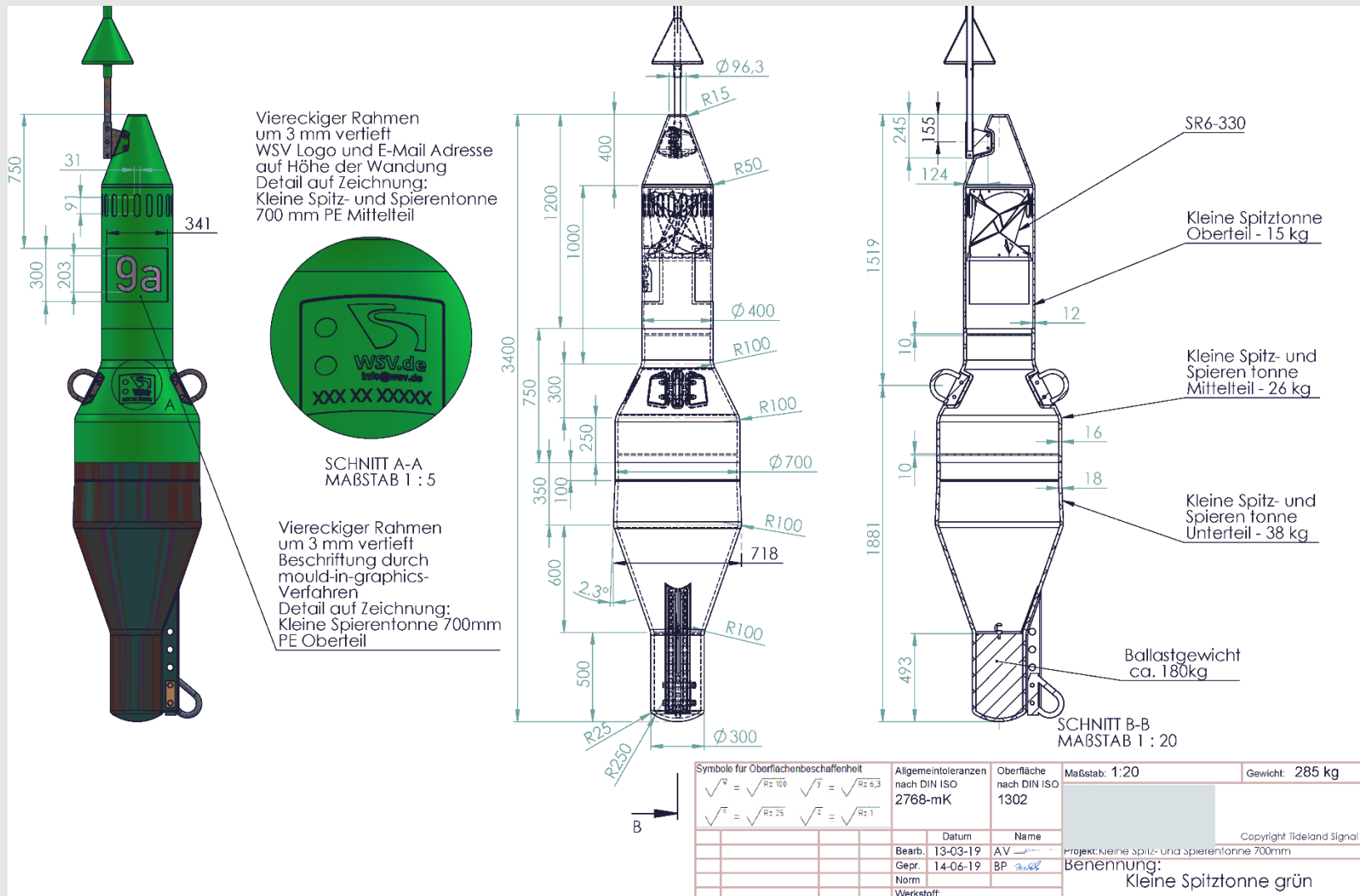
- For the assessment of the bids the price was not the only criterion.
- Additional criteria were the “economic efficiency” and the “technical value”.
- The manufacturer's work during the production process is closely monitored (WSV and engineering office).
- Important phases and milestones are:
 - ✓ examination and approval of the execution planning
 - ✓ tests on first samples of plastic components, metal parts and completed plastic buoys
 - ✓ destructive tensile tests of plastic buoys to verify the safe working load and the breaking load
 - ✓ factory quality inspections
 - ✓ tests during the series production



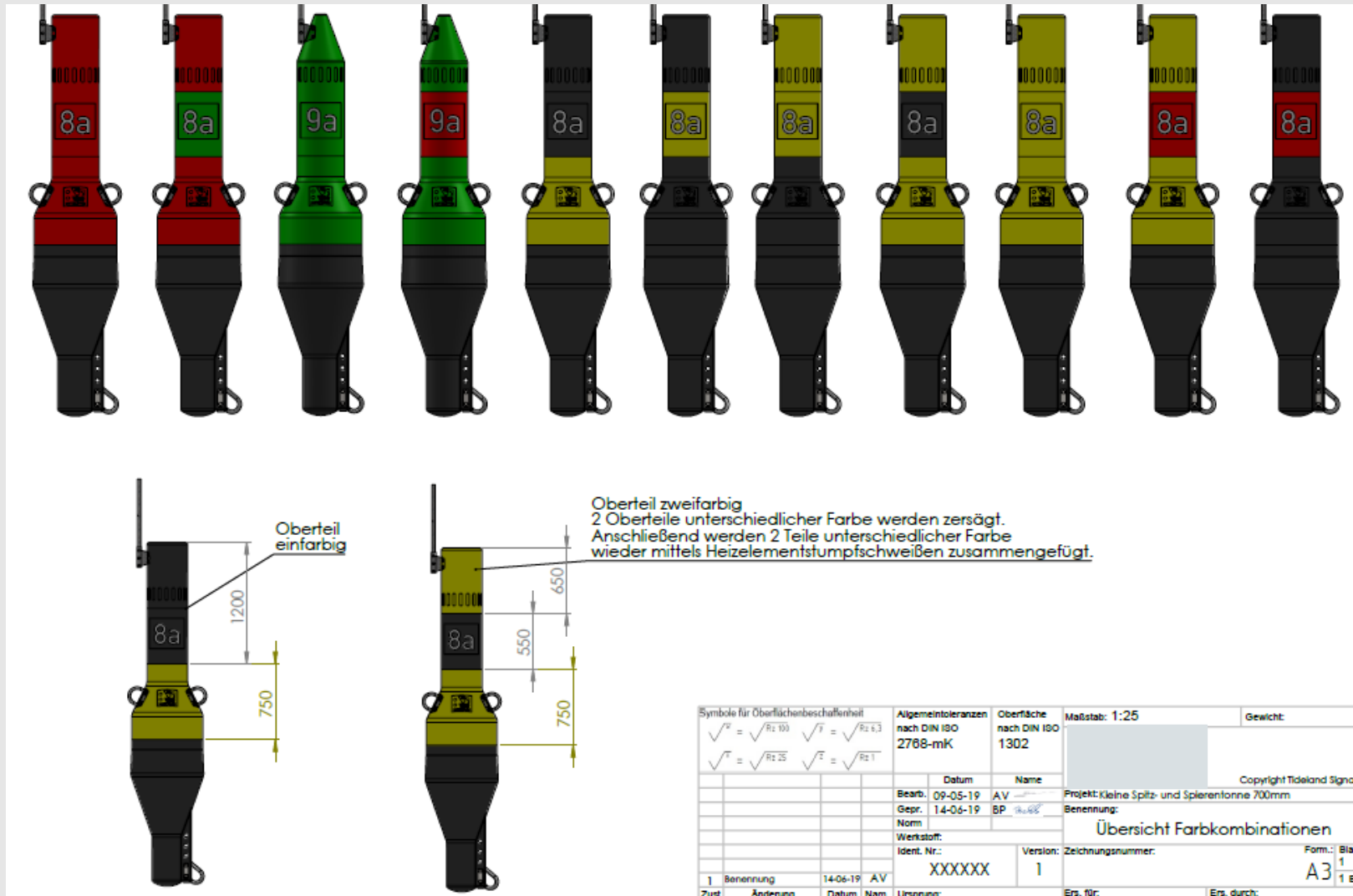
The first tender: WSV spar buoy, 700 mm



The first tender: WSV conical buoy, 700 mm



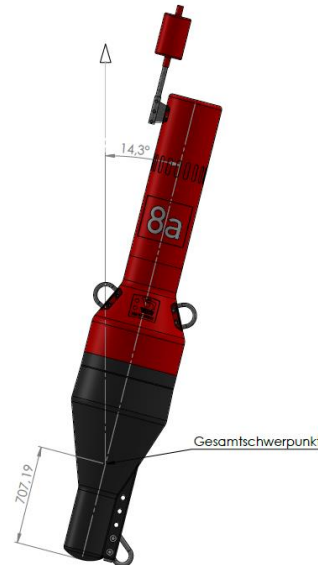
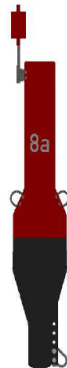
The first tender: color combinations



The first tender: swimming stability

Schwimmstabilitätsberechnung - Kleine Spitz- und Spierentonne - REV4

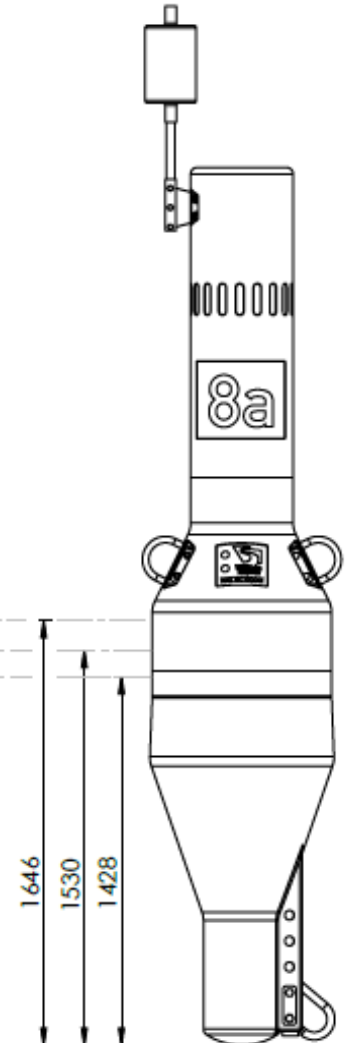
Eingabe			Ergebnis		
Tonnentyp : Kleine Spitz- und Spierentonne			Tonnentyp : Kleine Spitz- und Spierentonne		
Kettenlänge :	0	Meter			
Windgeschwindigkeit :	10	Beaufort			
Strömung :	7	Km/h			
Tonnen-Info					
Durchmesser Tonnenkörper :	700,00	mm	Gesamthöhe (ohne Toppzeichen) :	3400	mm
Höhe Tonnenkörper :	1450,00	mm	Gesamttiefgang :	1428	mm
Wandstärke :	18,00	mm	Gesamtmasse (m) :	287	kg
Lichtpunkthöhe oberhalb der Wasserlinie :	1972	mm	Tonnekette Ø18 DIN5683 :	0	Meter
Höhe (Tail) :	500	mm	Gewicht Tonnekette :	0	kg
Ballastgewicht :	180	kg	Freibord (bis zur Oberseite des konischen Mittelteils) :	572	mm
			Trägheitsmoment der Wasserlinie (IT) :	11785881189,48	mm ⁴
			Metazentrum zum Auftriebsmittelpunkt (BM) :	42,16	mm
			Auftriebsmittelpunkt von Basis (KB) :	1018,85	mm
			Metazentrische Höhe von Basis (GM) :	353,82	mm
			Gesamtschwerpunkt von Basis (KG) :	707,19	mm
			Metazentrische Höhe zum Gesamtschwerpunkt (MG) :	353,37	mm
			Schräglage bei Wind :	74,25	Grad
			Schräglage bei Strömung :	74,52	Grad
			Pendelperiode :	3,01	Sekunden
			Eigenfrequenz :	0,33	Hz



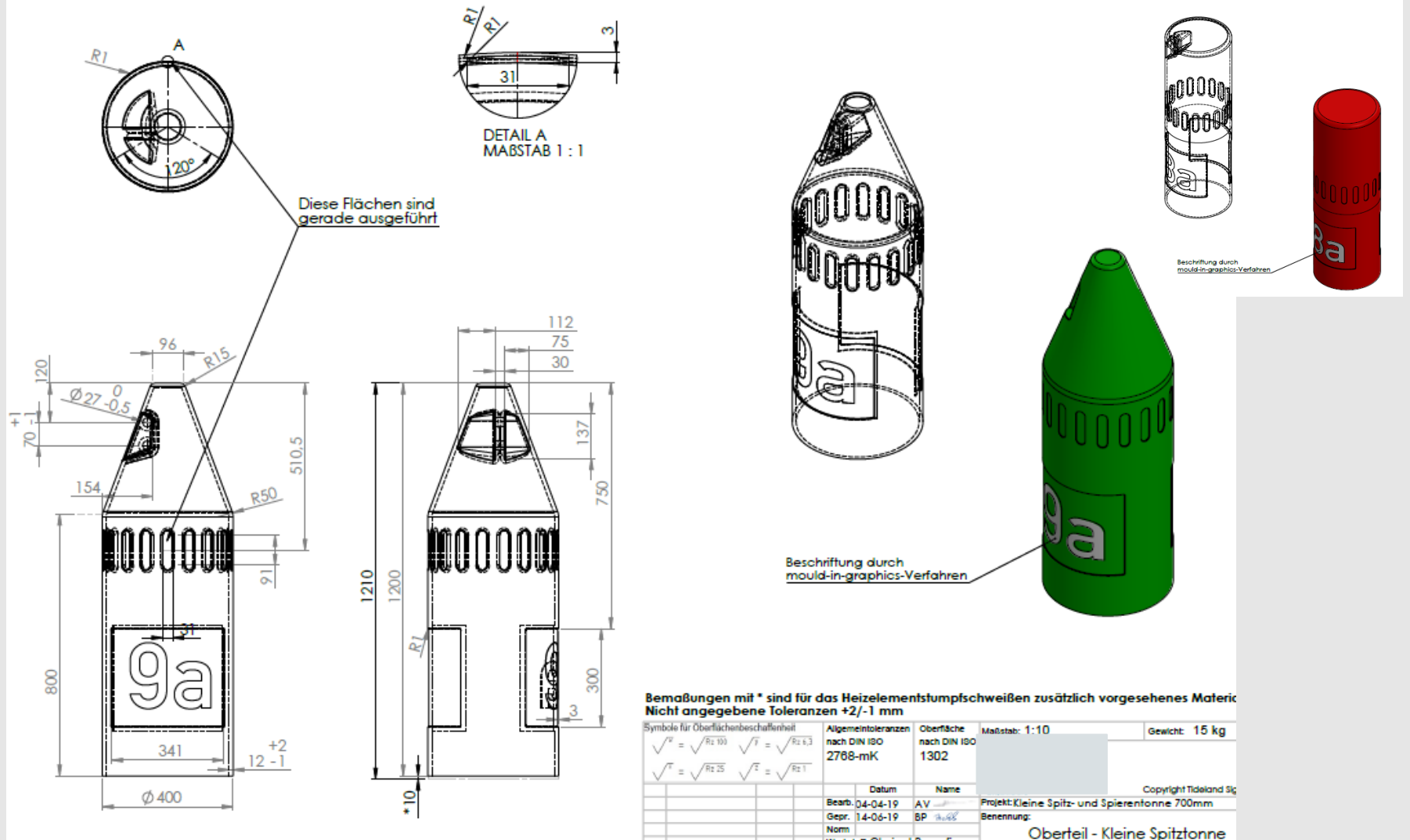
Auswertung der Schwimmstabilitätsberechnung

Kleine Spitz- und Spierentonne

Wasserlinie bei 15 Meter Kette
Wasserlinie 7 bei Meter Kette
Wasserlinie ohne Kette

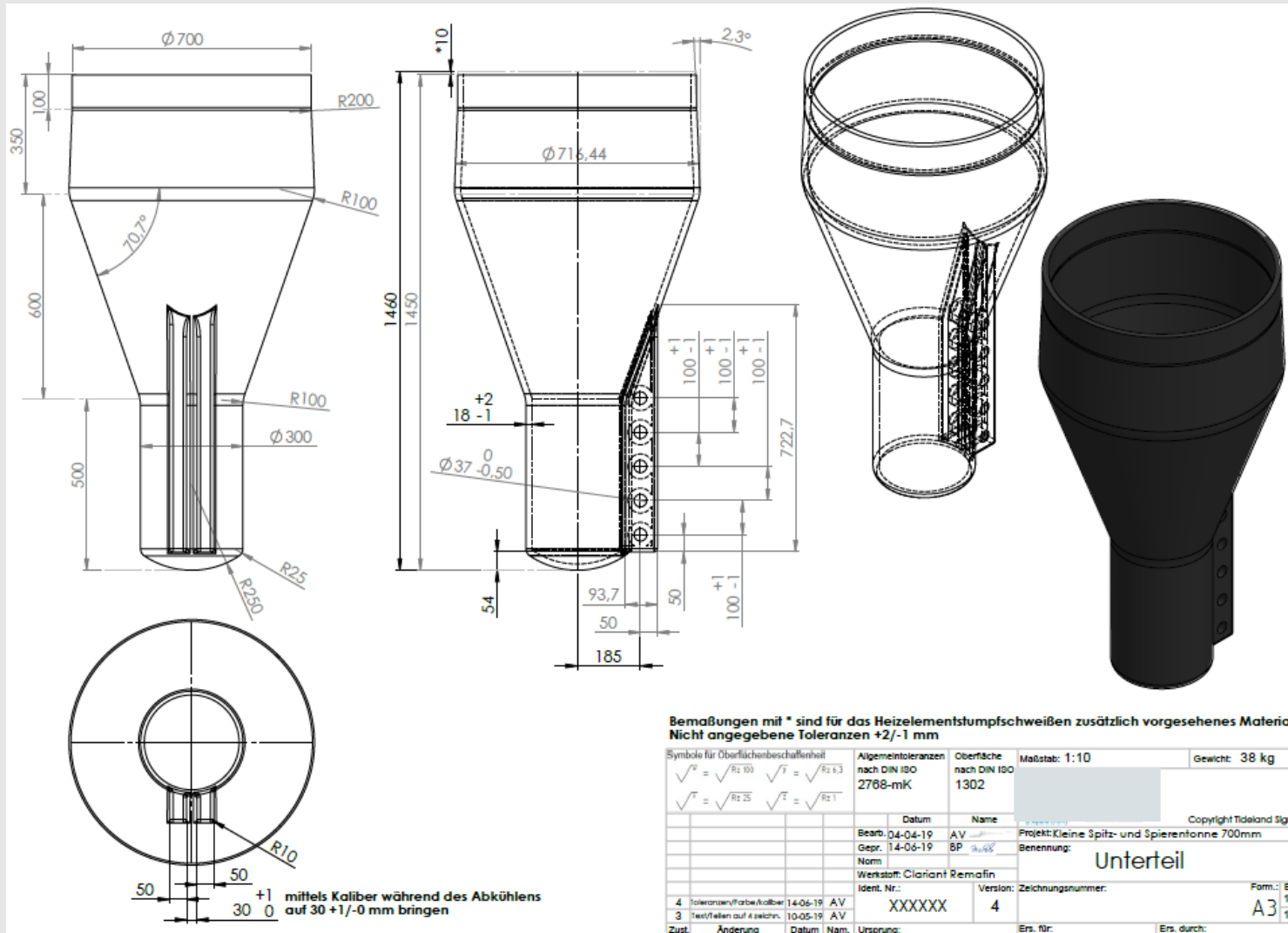


The first tender: top module

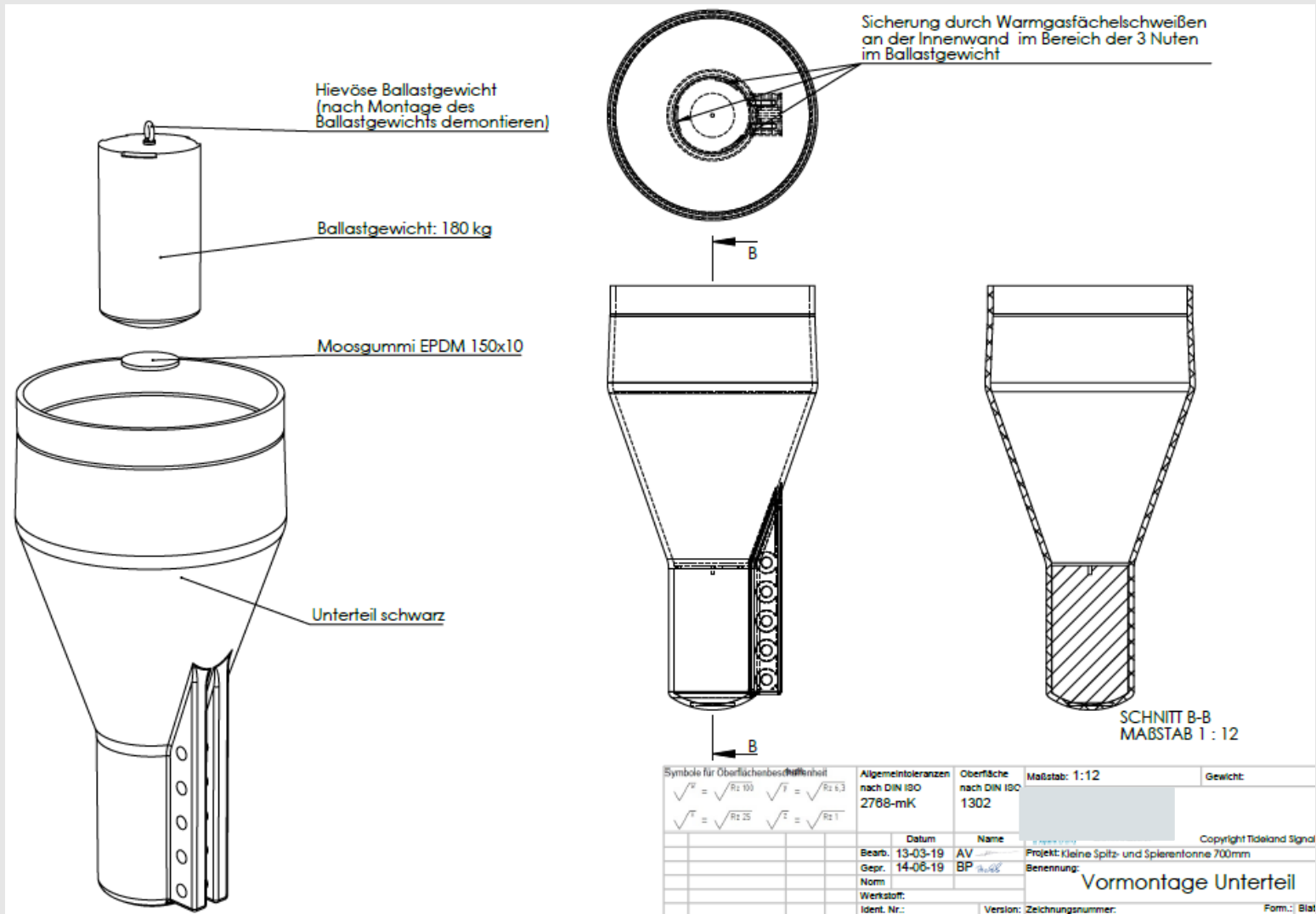


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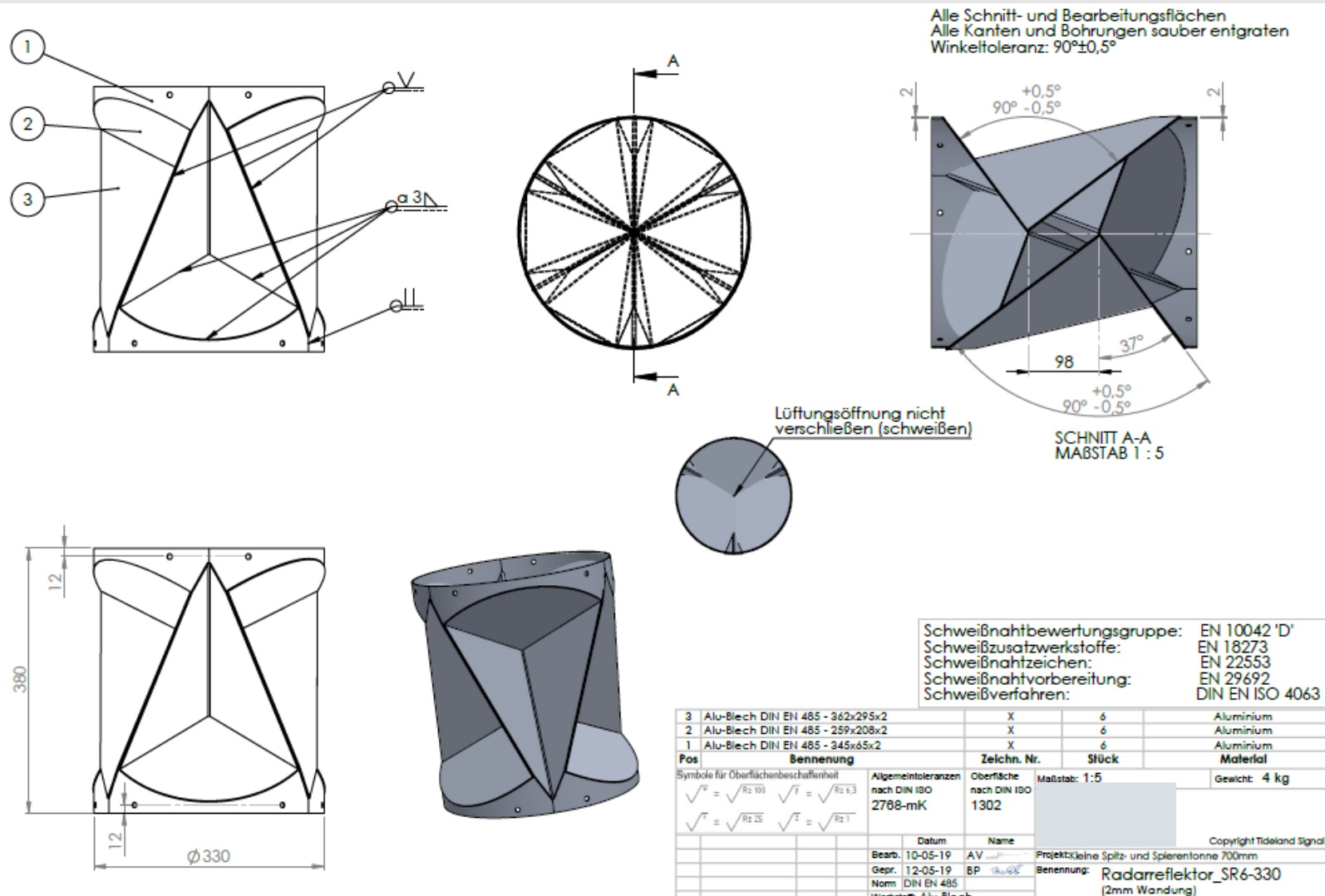
The first tender: lower module



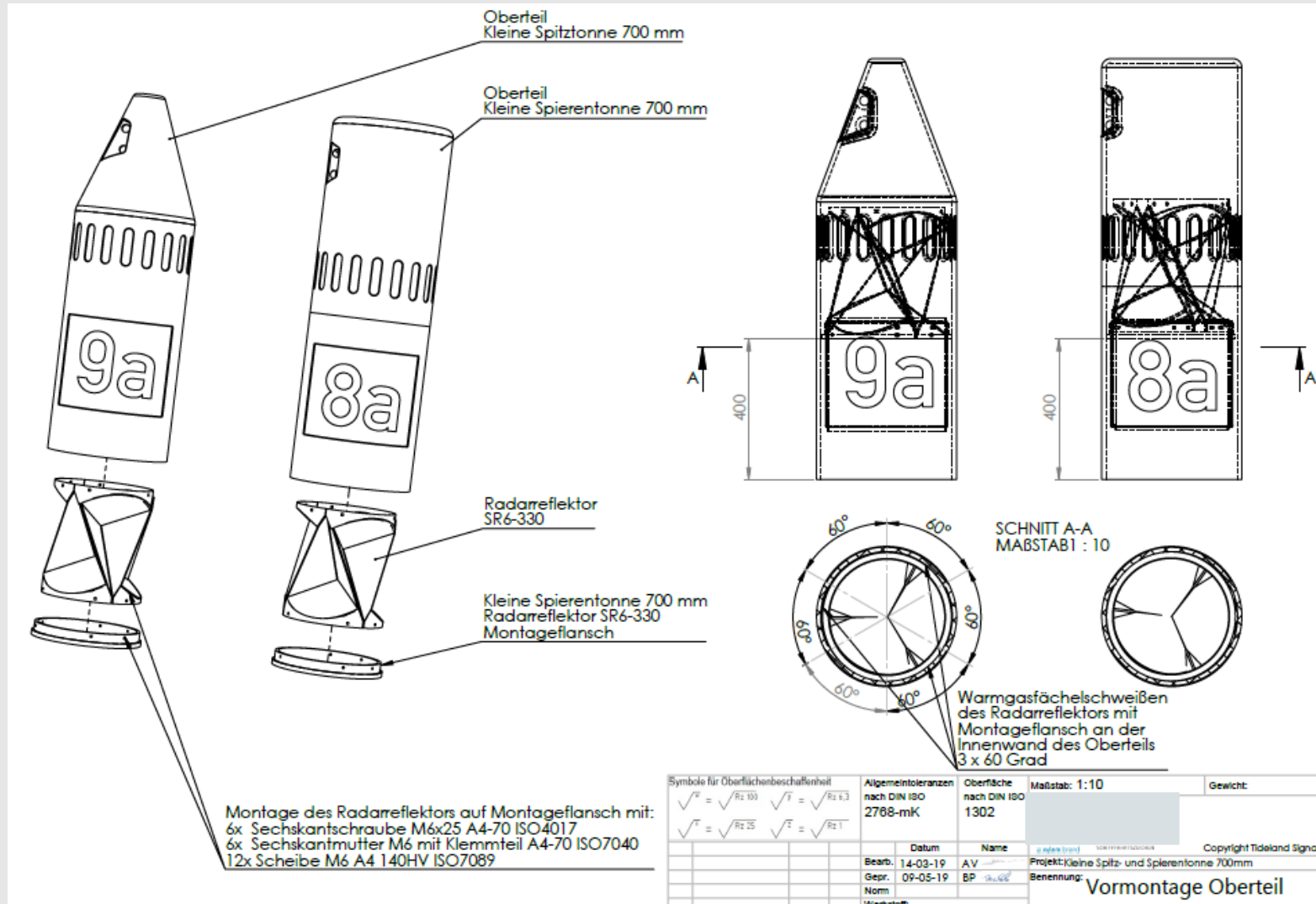
The first tender: lower module, ballast weight



The first tender: radar reflector, type “SR6-330”

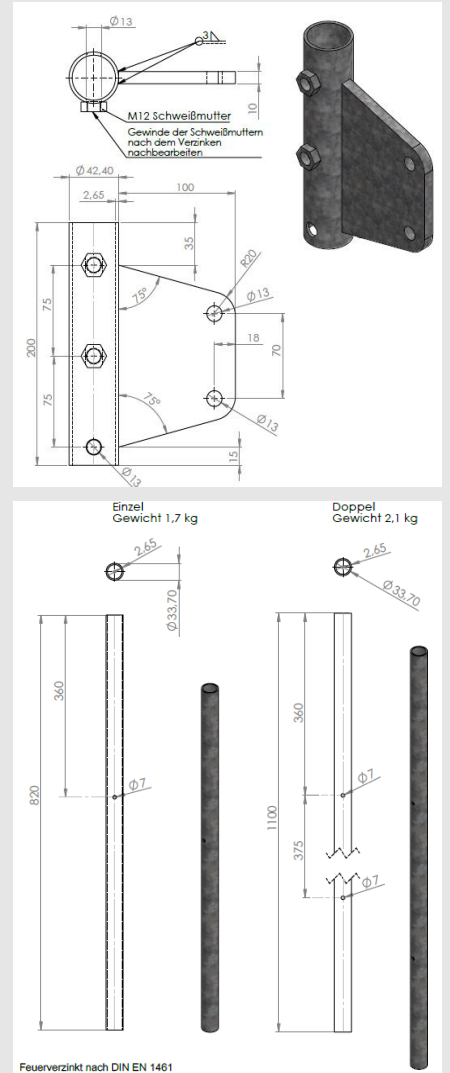
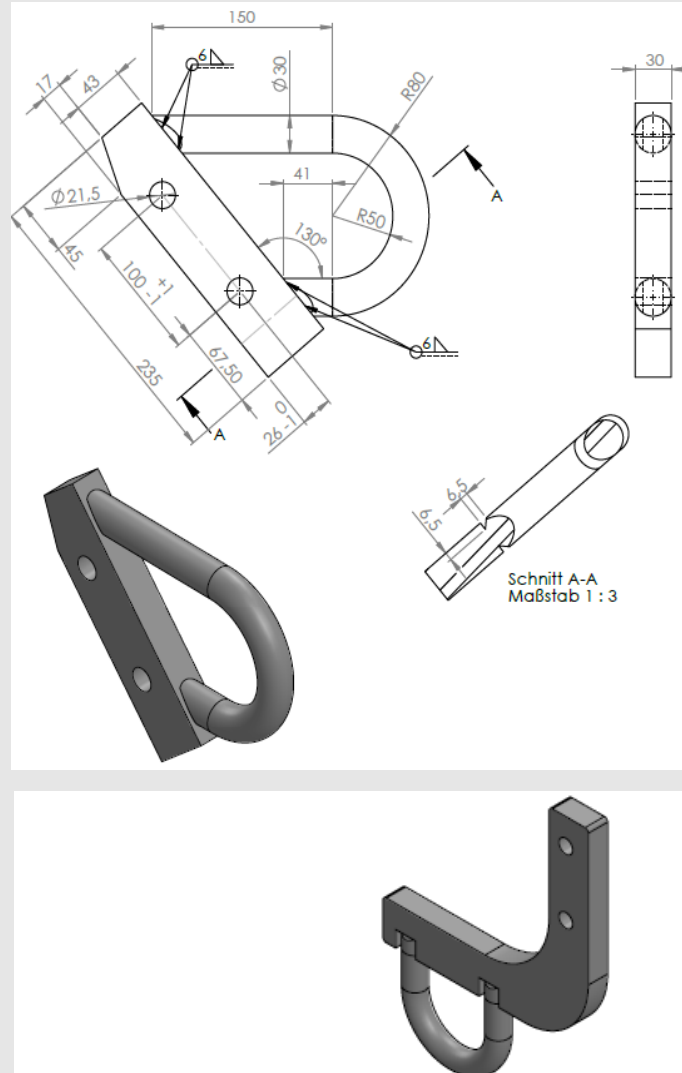


The first tender: mounting of the radar reflector

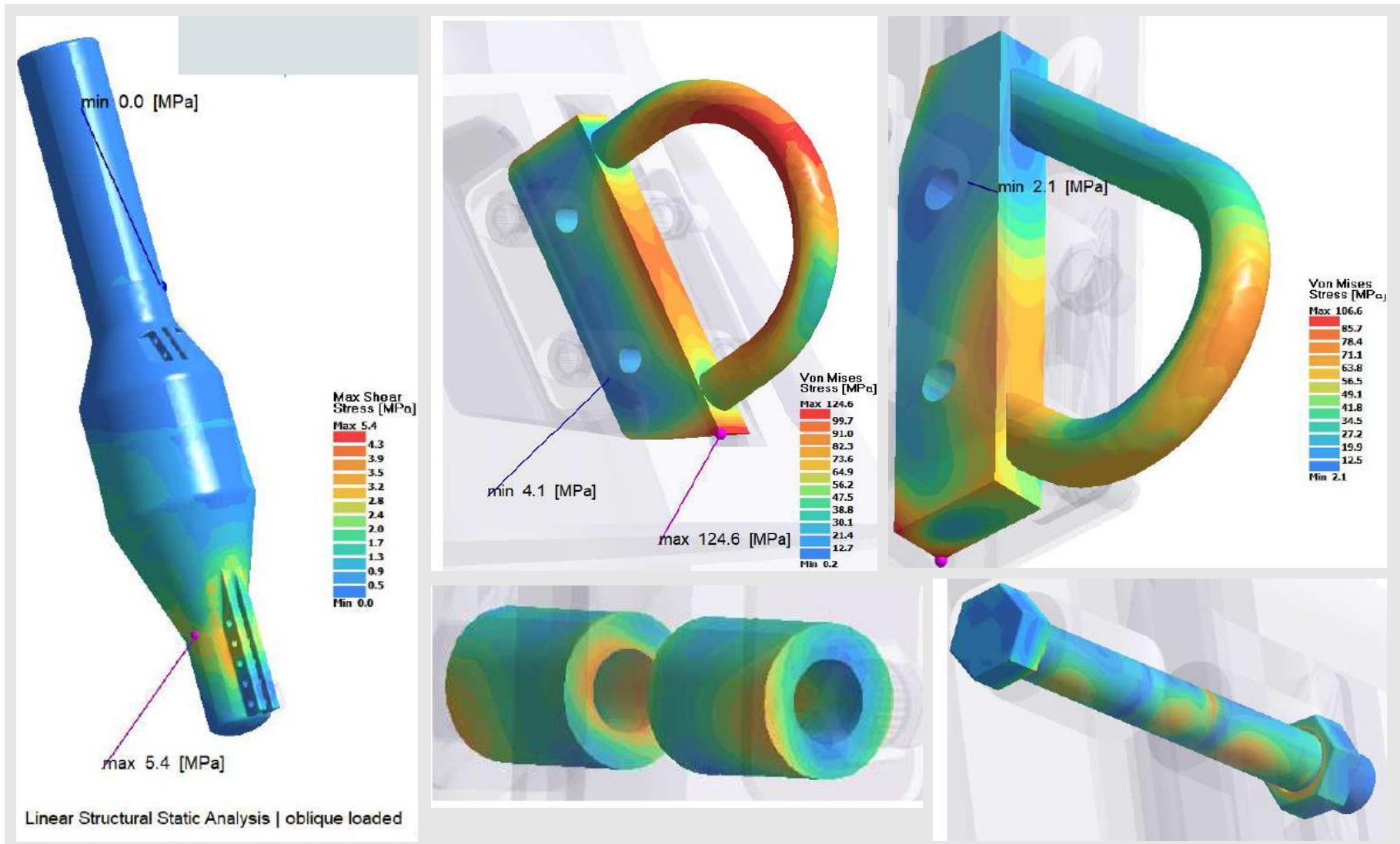


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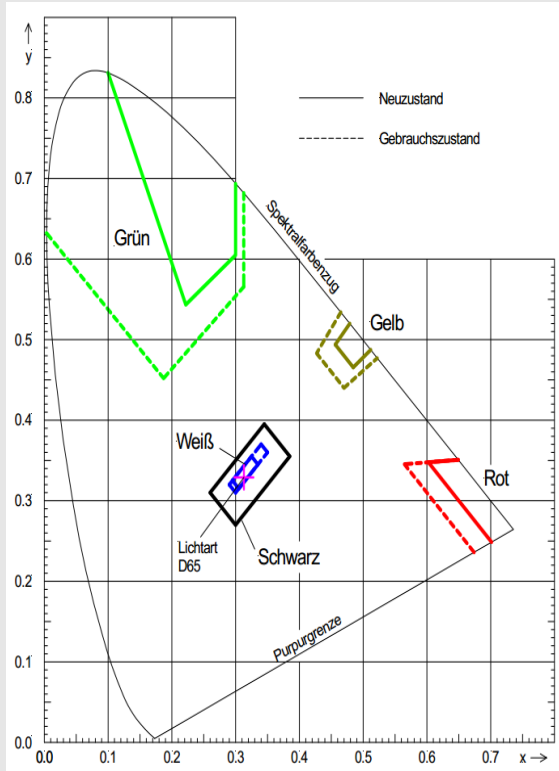
Kanten brechen
Schweißverfahren: NEN EN 1090 exc. Class 2
Doppelnähte sind umschlossen verschweißt.
Feuerverzinkt nach DIN EN 1461



The first tender: calculation / simulation of tensile strength



The first tender: colorimeter



The first tender: mounting concept, quality control concept



Montagekonzept

Kleine Spitz- und Spierentonne



Prüfkonzept

Kleine Spitz- und Spierentonne

The environmental impact of plastic buoys

- With regard to the environment, the following aspects can be expected:
 - ✓ Due to the longer lay-out times, the number of ship operations can be reduced (positive CO2-balance).
 - ✓ The sandblasting (waste) and the coating (solvents) can be avoided.
- Influence of plastic buoys on the much discussed pollution of oceans by plastic waste:
 - ✓ Plastic waste comes mainly into the sea from land (sewage, illegal waste disposal, tourism, etc.), ships (including fishing vessels), aquaculture and offshore installations (~ 8 million tons per year).
- This is not really relevant to plastic buoys:
 - ✓ Plastic buoys give almost no plastic into the sea during their lifetime.
 - ✓ Plastic buoys will be removed after their lifetime and will be recycled.
 - ✓ The recycling is easy: The buoy procurement already ensures the purity of the plastic material (no special waste).



Thanks for your attention!

Contact

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