Standardized Storage Silos

Standardized Storage Silos

Zeppelin Silo- und Apparatetechnik GmbH is the world's leading manufacturer of silos. As a result of our comprehensive experience in the handling of bulk solids and the production of silos, we are able to supply an extensive range of standardized silos in addition to individual products made to customers` specification. The range of standard silos for the storage of bulk solids is augmented by a series of gravity-type blending silos. These permit the blending and homogenizing of bulk solids during the product discharge stage.

In addition, we are able to supply all the accessories needed to ensure the dependable, maintenance-free operation of the silo installation.

Standard Silo Range:

Static Configuration

Pure standard silos are designed to be used with a wide spectrum of bulk solids and are able to meet most operating requirements without design modifications. The design loads on which the structural strength of the silos is based are determined in accordance with DIN1055, part 6. A-prerequisite for compliance with this standard is that the bulk solids should be of a granular or powdery consistency and, in any case, be of a free-flowing nature with a minimal tendency to coagulate. The product must be discharged by way of a central outlet only, without developing asymmetric flow patterns. Specifically, our static stress calculations are based on the following assumptions relating to the bulk solids.

- Design pressure = +45/-5 mbar
- Specific gravity of bulk goods γ = 6,0 kN/m³ or 10 kN/m³
- Horizontal load factor λ = 0,5 - 0,7
- Wall friction coefficient μ = 0,3 - 0,4
- Discharging load factor e_η = 1,2
- Bulk material coefficient β_G = 0,4
- Base loading factor c_b = 1,5

On the basis of these assumed loads, around 80 % of all bulk solids can be provided for. In cases involving bulk solids having properties at variance with the data given above, or which do not flow freely or have a tendency to eccentric discharge, even if only at times, we require specific information to be supplied. We manufacture standard silos even for these products, but in such cases it is necessary to draw up a separate stress analysis, taking account of the variations in product data.

This applies equally to silos which will be subjected to external loadings in excess of the figures given below. Variations in external loadings occur primarily in coastal areas or on exposed sites. The ability of silos to withstand earth tremors depends on the ratio of the height of the silo to its diameter. In general, silos are designed to withstand intensity 7 on the MSK scale or for use in earthquake zone 2, as specified in DIN 4149. In cases involving other earthquake zones, we should be notified before the order is placed, so that we can verify the resistance capacity of the silo in the stress analysis. We are always willing to quote you individually for our standard silos.

In case where heavier-gauge walls are required by comparison with our standard silos, because of variations in the bulk solids properties or more severe external loadings, we will identify the supplementary charges in your quotation.

Accepted loadings for standard silo design: + 45/-5 mbar

- Wind pressure load up to 8 m above ground level:		q = 0,5 kN/m²
- Wind pressure load up to 8 m to 20 m above ground level:		q = 0,8 kN/m²
- Wind pressure load up to 8 m above ground level:		q = 1,1 kN/m²
- Load on roof (snow and live loads):	d ≤ 4200 mm	q = 1,0 kN/m²
	d > 4200 mm	q = 0,75 kN/m²
- Concentrated load on silo roof:		P = 1,0 kN
- Area loading for connecting frames including snow load:		q = 1,5 kN/m²
- max. mounting height for silos with short skirt:		8m above ground level
	with long skirt:	at ground level

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Standardized Storage Silos

Determining the Flow Characteristics of Bulk Solids

Data on the flow characteristics of the bulk solids concerned are of the utmost importance for the configuration of the silo and, in turn, the trouble-free discharge of the product. If the flow behaviour of the bulk material is not specifically known, we recommend that shear tests be carried out in accordance with the FEM 2.381 guideline. These tests do not only permit the parameters to be determined which are necessary for the silo to be designed in accordance with the strength requirements laid down in DIN 1055, part 6, but also help in the selection and dimensioning of a suitable method of product discharge, so that the latter process ca be guaranteed to take place without any problems.

Installation

Wewill,ifrequired, carry out the entire silo installation or will provide the services of supervisors or skilled installers. By this means, the installation will be carried out rapidly and cost-effectively.

Quality Assurance

The exceptionally high quality standards (proved by our certification according to DIN ISO 9001/EN 29001) to which our products are made, is assured by our highly trained workforce and our modern manufacturing processes. In addition, our standard silos are subject to continuous, self-regulated inspections during manufacture and undergo further acceptance testing before delivery. As a result, we guarantee that our customers receive silos made to consistently high quality standard. Needless to say, we are also able to provide further proof of quality if required, such as ultrasonic and x-ray tests on welded seams, together with leak tests, dye penetration tests, etc.

Let's talk about it!

The present technical data sheets are a summary of the current ZEPPELIN product program. They intend to help the customer in his planing processes. With this manual you take part in the continuous upgrading of the ZEPPELIN program. The ZEPPELIN advice center will automatically supply you with information about newly developed or improved products. Thus you are always up to date about the latest developments in "Silo Technology".

You can use the attached fax form to send us your quotation.

For further questions please do not hesitate to contact our experts personally. They are easily available at the ZEPPELIN advice center in Friedrichshafen and they will be happy to help you in a friendly and competent way.

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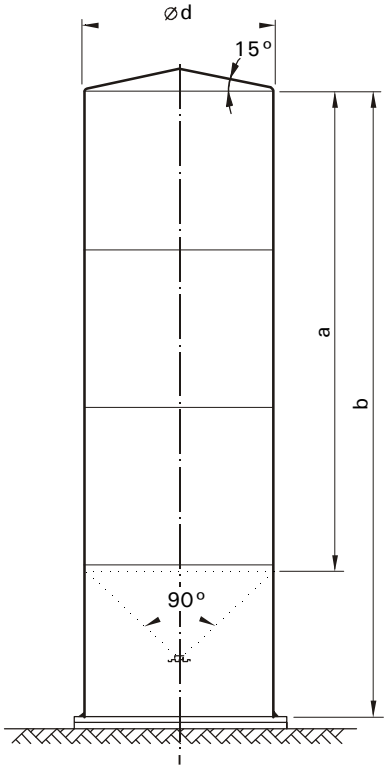
Storage silos

Material: EN AW-5754 (AlMg3)
Silo configuration: Roof slope 15°, hopper with 90° angle of discharge
Standard accessories: 1 Set of lifting lugs
All dimensions in mm

Silo type NL (with long skirt)	**Silo dimensions**	**Price code**	**Price code**
Silo with long skirt and base ring for full support.	**d = 2400**	**Type NL-24-9-6 Bulk density 6 kN/m³**	**Type NL-24-9-1 Schüttgew. 10 kN/m³**
	26 m³ a = 5500 b = 7500	NL2496 026	NL2491 026
	37 m³ a = 8000 b = 10000	NL2496 037	NL2491 037
	48 m³ a = 10500 b = 12500	NL2496 048	NL2491 048
	60 m³ a = 13000 b = 15000	NL2496 060	NL2491 060
	70 m³ a = 15500 b = 17500	NL2496 070	NL2491 070
	**d = 3000**	**Type NL-30-9-6 Bulk density 6 kN/m³**	**Type NL-30-9-1 Bulk density 10 kN/m³**
	40 m³ a = 5100 b = 7500	NL3096 040	NL3091 040
	55 m³ a = 7600 b = 10000	NL3096 055	NL3091 055
	65 m³ a = 8850 b = 11250	NL3096 065	NL3091 065
	75 m³ a = 10100 b = 12500	NL3096 075	NL3091 075
	83 m³ a = 11350 b = 13750	NL3096 083	NL3091 083
	90 m³ a = 12600 b = 15000	NL3096 090	NL3091 090
	100 m³ a = 13850 b = 16250	NL3096 100	NL3091 100
	110 m³ a = 15100 b = 17500	NL3096 110	NL3091 110
	125 m³ a = 17600 b = 20000	NL3096 125	NL3091 125
	d = 3500	**Type NL-35-9-6 Bulk density 6 kN/m³**	
	53 m³ a = 4900 b = 7500	NL3596 053	
	65 m³ a = 6150 b = 8750	NL3596 065	
	77 m³ a = 7400 b = 10000	NL3596 077	
	100 m³ a = 9900 b = 12500	NL3596 100	
	125 m³ a = 12400 b = 15000	NL3596 125	
	150 m³ a = 14900 b = 17500	NL3596 150	
	173 m³ a = 17400 b = 20000	NL3596 173	
	197 m³ a = 19900 b = 22500	NL3596 197	
	221 m³ a = 22400 b = 25000	NL3596 221	
	245 m³ a = 24900 b = 27500	NL3596 245	
	d = 4200	**Type NL-42-9-6 Bulk density 6 kN/m³**	
If you cannot foresee a silo of a standard diameter due to building constraints or other reasons, please consult us. In such cases, we are able to supply suitable products.	105 m³ a = 6900 b = 10000	NL4296 105	
	140 m³ a = 9400 b = 12500	NL4296 140	
	174 m³ a = 11900 b = 15000	NL4296 174	
	208 m³ a = 14400 b = 17500	NL4296 208	
	243 m³ a = 16900 b = 20000	NL4296 243	
	278 m³ a = 19400 b = 22500	NL4296 278	
	312 m³ a = 21900 b = 25000	NL4296 312	

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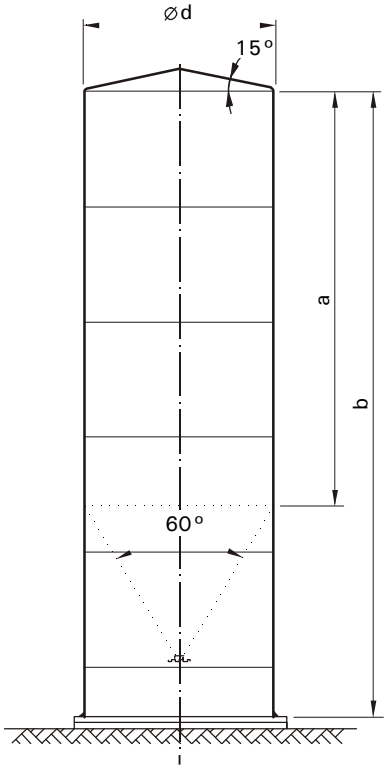
Storage silos

Material: EN AW-5754 (AlMg3)
Silo configuration: Roof slope 15°,hopper with 60° angle of discharge
Standard accessories: 1 Set of lifting lugs
All dimensions in mm

Silo with long skirt and base ring for full support.



If you cannot foresee a silo of a standard diameter due to building constraints or other reasons, please consult us. In such cases, we are able to supply suitable products.

Silo Type NL (with long skirt)	Silo dimensions	Price code	Price code
		Type NL-24-6-6 Bulk density 6 kN/m³	**Type NL-24-6-1 Bulk density 10 kN/m³**
	d = 2400		
	25 m³ a = 4800 b = 7500	NL2466 025	NL2461 025
	36 m³ a = 7300 b = 10000	NL2466 036	NL2461 036
	47 m³ a = 9800 b = 12500	NL2466 047	NL2461 047
	58 m³ a = 12300 b = 15000	NL2466 058	NL2461 058
	70 m³ a = 14800 b = 17500	NL2466 070	NL2461 070
		Type NL-30-6-6 Bulk density 6 kN/m³	**Type NL-30-6-1 Bulk density 10 kN/m³**
	d = 3000		
	35 m³ a = 4200 b = 7500	NL3066 035	NL3061 035
	45 m³ a = 5450 b = 8750	NL3066 045	NL3061 045
	55 m³ a = 6700 b = 10000	NL3066 055	NL3061 055
	70 m³ a = 9200 b = 12500	NL3066 070	NL3061 070
	80 m³ a = 10450 b = 13750	NL3066 080	NL3061 080
	90 m³ a = 11700 b = 15000	NL3066 090	NL3061 090
	105 m³ a = 14200 b = 17500	NL3066 105	NL3061 105
	125 m³ a = 16700 b = 20000	NL3066 125	NL3061 125
	140 m³ a = 19200 b = 22500	NL3066 140	NL3061 140
	150 m³ a = 20450 b = 23750	NL3066 150	NL3061 150
		Type NL-35-6-6 Bulk density 6 kN/m³	**Type NL-35-6-1 Bulk density 10 kN/m³**
	d = 3500		
	45 m³ a = 3750 b = 7500	NL3566 045	NL3561 045
	58 m³ a = 5000 b = 8750	NL3566 058	NL3561 058
	70 m³ a = 6250 b = 10000	NL3566 070	NL3561 070
	94 m³ a = 8750 b = 12500	NL3566 094	NL3561 094
	118 m³ a = 11250 b = 15000	NL3566 118	NL3561 118
	142 m³ a = 13750 b = 17500	NL3566 142	NL3561 142
	154 m³ a = 15000 b = 18750	NL3566 154	NL3561 154
	166 m³ a = 16250 b = 20000	NL3566 166	NL3561 166
	190 m³ a = 18750 b = 22500	NL3566 190	NL3561 190
	200 m³ a = 20000 b = 23750	NL3566 200	NL3561 200
	212 m³ a = 21250 b = 25000	NL3566 212	NL3561 212
	236 m³ a = 23750 b = 27500	NL3566 236	NL3561 236
		Type NL-42-6-6 Bulk density 6 kN/m³	**Type NL-42-6-1 Bulk density 10 kN/m³**
	d = 4200		
	93 m³ a = 5500 b = 10000	NL4266 093	NL4261 093
	127 m³ a = 8000 b = 12500	NL4266 127	NL4261 127
	162 m³ a = 10500 b = 15000	NL4266 162	NL4261 162
	196 m³ a = 13000 b = 17500	NL4266 196	NL4261 196
	231 m³ a = 15500 b = 20000	NL4266 231	NL4261 231
	266 m³ a = 18000 b = 22500	NL4266 266	NL4261 266
	300 m³ a = 20500 b = 25000	NL4266 300	NL4261 300

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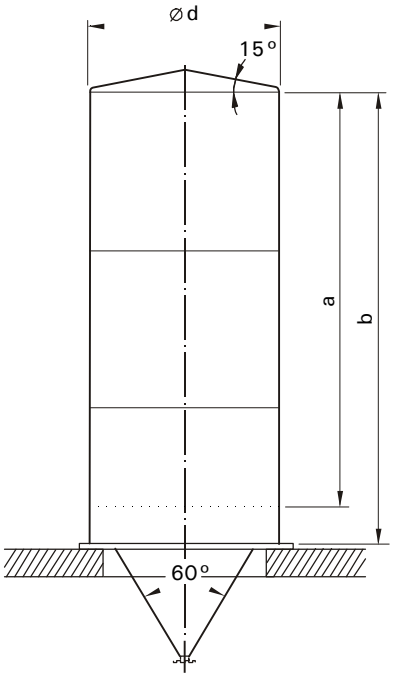
Storage silos

Material: EN AW-5754 (AlMg3)
Silo configuration: Roof slope 15°, hopper with 60° angle of discharge
Standard accessories: 1 set of lifting lugs
All dimensions in mm

Silo Type NK (with short skirt)	**Silo dimensions**	**Price code**	**Price code**
Silo with short skirt and base ring for full support.	**d = 2400**	**Type NK-24-6-6 Bulk density 6 kN/m³**	**Type NK-24-6-1 Bulk density 10 kN/m³**
	23 m³ a = 4500 b = 5000	NK2466 023	NK2461 023
	29 m³ a = 5750 b = 6250	NK2466 029	NK2461 029
	34 m³ a = 7000 b = 7500	NK2466 034	NK2461 034
	46 m³ a = 9500 b = 10000	NK2466 046	NK2461 046
	57 m³ a = 12000 b = 12500	NK2466 057	NK2461 057
	68 m³ a = 14500 b = 15000	NK2466 068	NK2461 068
	d = 3000	**Type NK-30-6-6 Bulk density 6 kN/m³**	**Type NK-30-6-1 Bulk density 10 kN/m³**
	38 m³ a = 4500 b = 5000	NK3066 038	NK3061 038
	55 m³ a = 7000 b = 7500	NK3066 055	NK3061 055
	64 m³ a = 8250 b = 8750	NK3066 064	NK3061 064
	72 m³ a = 9500 b = 10000	NK3066 072	NK3061 072
	82 m³ a = 10750 b = 11250	NK3066 082	NK3061 082
	90 m³ a = 12000 b = 12500	NK3066 090	NK3061 090
	100 m³ a = 13250 b = 13750	NK3066 100	NK3061 100
	125 m³ a = 17000 b = 17500	NK3066 125	NK3061 125
	d = 3500	**Type NK-35-6-6 Bulk density 6 kN/m³**	**Type NK-35-6-1 Bulk density 10 kN/m³**
	76 m³ a = 7000 b = 7500	NK3566 076	NK3561 076
	100 m³ a = 9500 b = 10000	NK3566 100	NK3561 100
	124 m³ a = 12000 b = 12500	NK3566 124	NK3561 124
	148 m³ a = 14500 b = 15000	NK3566 148	NK3561 148
	172 m³ a = 17000 b = 17500	NK3566 172	NK3561 172
	196 m³ a = 19500 b = 20000	NK3566 196	NK3561 196
	220 m³ a = 22000 b = 22500	NK3566 220	NK3561 220
	244 m³ a = 24500 b = 25000	NK3566 244	NK3561 244
	d = 4200	**Type NK-42-6-6 Bulk density 6 kN/m³**	**Type NK-42-6-1 Bulk density 10 kN/m³**
	148 m³ a = 9500 b = 10000	NK4266 148	NK4261 148
	182 m³ a = 12000 b = 12500	NK4266 182	NK4261 182
	217 m³ a = 14500 b = 15000	NK4266 217	NK4261 217
	252 m³ a = 17000 b = 17500	NK4266 252	NK4261 252
	286 m³ a = 19500 b = 20000	NK4266 286	NK4261 286
	321 m³ a = 22000 b = 22500	NK4266 321	NK4261 321
	355 m³ a = 24500 b = 25000	NK4266 355	NK4261 355

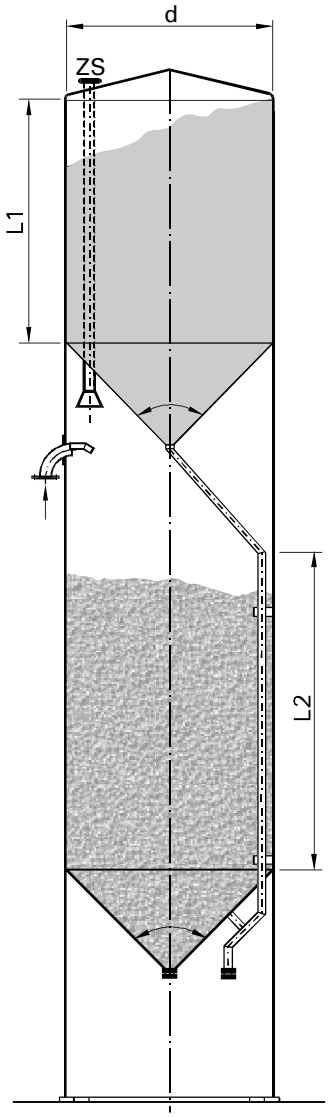


If you cannot foresee a silo of a standard diameter due to building constraints or other reasons, please consult us. In such cases, we are able to supply suitable products.

Storage silos

Multi-chamber silos

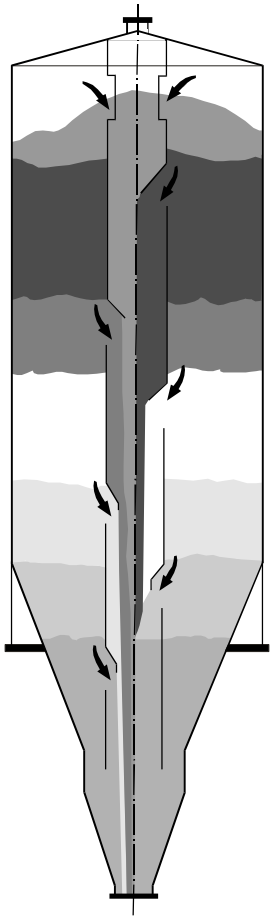
Material: EN AW-5754 (AlMg3)
Silo configuration: Roof slope 15°, hopper with opening angle 60°/90°
Standard accessories: 1 set of crane lugs
All dimensions in mm



Designation	Price code
Additional discharge funnel with 90° opening angle	
Conical bottom for d = 2400 for bulk density 6 kN/m³	**ZK2496**
Conical bottom for d = 3000 for bulk density 6 kN/m³	**ZK3096**
Conical bottom for d = 3500 for bulk density 6 kN/m³	**ZK3596**
Conical bottom for d = 4200 for bulk density 6 kN/m³	**ZK4296**
Conical bottom for d = 2400 for bulk density 10 kN/m³	**ZK2491**
Conical bottom for d = 3000 for bulk density 10 kN/m³	**ZK3091**
Conical bottom for d = 3500 for bulk density 10 kN/m³	**ZK3591**
Conical bottom for d = 4200 for bulk density 10 kN/m³	**ZK4291**
Additional discharge funnel with 60° opening angle	
Conical bottom for d = 2400 for bulk density 6 kN/m³	**ZK2466**
Conical bottom for d = 3000 for bulk density 6 kN/m³	**ZK3066**
Conical bottom for d = 3500 for bulk density 6 kN/m³	**ZK3566**
Conical bottom for d = 4200 for bulk density 6 kN/m³	**ZK4266**
Conical bottom for d = 2400 for bulk density 10 kN/m³	**ZK2461**
Conical bottom for d = 3000 for bulk density 10 kN/m³	**ZK3061**
Conical bottom for d = 3500 for bulk density 10 kN/m³	**ZK3561**
Conical bottom for d = 4200 for bulk density 10 kN/m³	**ZK4261**
Extension for discharge pipe, depending on installation height of additional conical bottom	
Basic price for discharge pipe DN 150	**ZL15**
Basic price for discharge pipe DN 200	**ZL20**
Extra charge for pipe elongation L2 per meter	**ZL1502**
Protective pipe DN 100 for Silot, flange at the top DN 100, connecting gauge PN 10with opening in hopper and centering cone at base.	**ZS10**
Basic price for protective pipe ZS	**ZS1000**
Extra charge for pipe elongation L1 per meter	**ZL1001**

Blending Silos

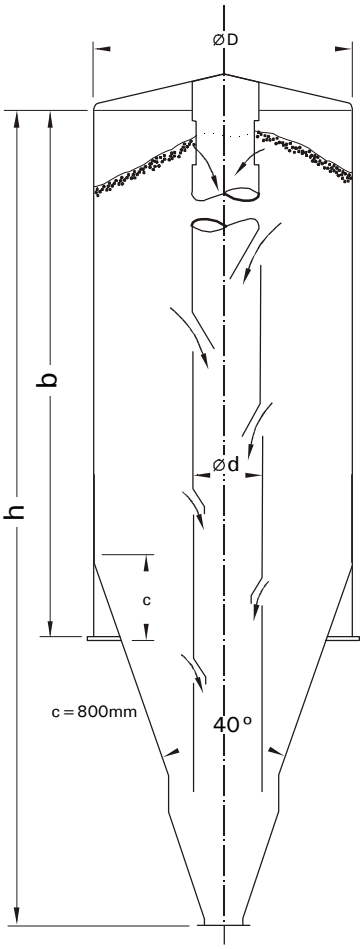
Centro-Blender

	Product description
	**Centro-Blender** continuous and batch-wise blending and homogenizing of bulk solids **Utilization** for solids having easy to poor flowability (plastic powders, recycling materials, pellets, flowable elastomers) **Components** vertical central blending pipe with intake openings at different levels cylindrical blending chamber **System description** Via the intake openings solids are simultaneously withdrawn from a multitude of layers from the annular space at different layers and led into the central blending pipe. The number and size of the intake openings are determined under consideration of the blender geometry and flow properties of the bulk solids. **Advantages** The Zeppelin Centro Blender offers the following advantages: no negative influence on the blending process consequent design for mass flow easy cleaning in case of change to a different product easy integration in the production process as the blender can be used for continuous and batch-wise blending high blending efficiency due to simultaneous withdrawal of solids from different layers for many applications of homogenization a single pass is sufficient, especially when the blender content is composed of a high number of individual batches

Blending Silos

Centro-Blender

Material: EN AW-5754 (AlMg3)
Silo configuration: Roof slope 15°, hopper with 40° angle of discharge
Standard accessories: 1 set of lifting lugs
All dimensions in mm



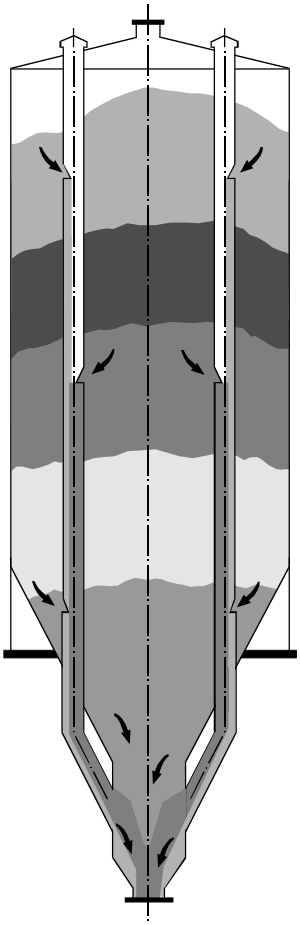
If you cannot foresee a silo of a standard diameter due to building constraints or other reasons, please consult us. In such cases, we are able to supply suitable products.

Silo dimensions	Price code
	Type CB-16-4-8
d = 1600	**Bulk density 8 kN/m³**
7 m³ d = 400 b = 3750 h = 5400	CB1648 007
10 m³ d = 400 b = 5000 h = 6650	CB1648 010
	Type CB-20-4-8
d = 2000	**Bulk density 8 kN/m³**
15 m³ d = 600 b = 5000 h = 8000	CB2048 015
20 m³ d = 600 b = 6250 h = 9250	CB2048 020
24 m³ d = 600 b = 7500 h = 10750	CB2048 024
	Type CB-22-4-8
d = 2200	**Bulk density 8 kN/m³**
25 m³ d = 600 b = 6250 h = 9500	CB2248 025
28 m³ d = 600 b = 7500 h = 10750	CB2248 028
	Type CB-24-4-8
d = 2400	**Bulk density 8 kN/m³**
30 m³ d = 600 b = 6250 h = 9800	CB2448 030
40 m³ d = 600 b = 8750 h = 12300	CB2448 040
50 m³ d = 600 b = 11250 h = 14800	CB2448 050
	Type CB-28-4-8
d = 2800	**Bulk density 8 kN/m³**
65 m³ d = 600 b = 10000 h = 14100	CB2848 065
	Type CB-30-4-8
d = 3000	**Bulk density 8 kN/m³**
75 m³ d = 600 b = 10000 h = 14000	CB3048 075
85 m³ d = 600 b = 11250 h = 15250	CB3048 085
100 m³ d = 600 b = 13750 h = 17750	CB3048 100
110 m³ d = 600 b = 15000 h = 19000	CB3048 110
	Type CB-35-4-8
d = 3500	**Bulk density 8 kN/m³**
105 m³ d = 800 b = 10000 h = 15050	CB3548 105
130 m³ d = 800 b = 12500 h = 17550	CB3548 130

The standard dimensions are based on the configuration for PVC dryblend and bulk solids with comparable flow characteristics. For other bulk solids, we configure Centro-Blend blending silos in accordance with the verified product flow characteristics.

Blending Silos

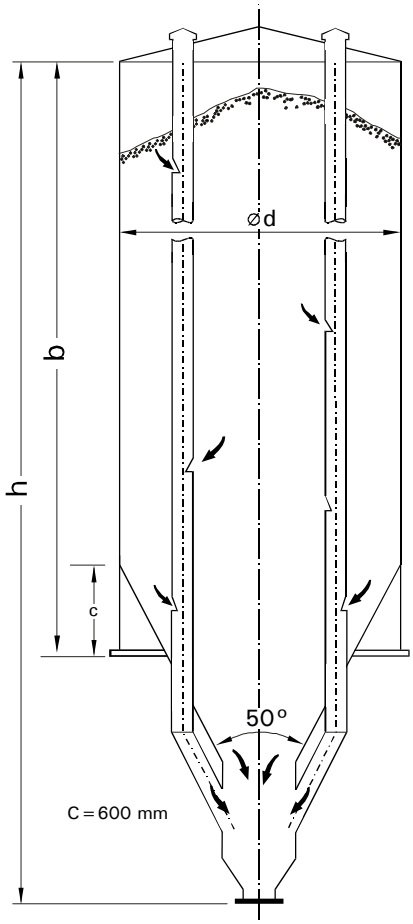
Multi-Pipe (Gravity Blender)

	Product description
	**Multi-Pipe Gravity Blender** **For free flowing, dry and cohesionless bulk solids with particle sizes above approx. 0.5 mm, especially pellets.** **Design** With extruded three-compartment pipes made from aluminium respectively stainless steel. Each individual chamber of the blending pipe has several intake openings. **Description** Via the intake openings of the blending pipes the bulk solids will flow from different zones in the silo into the central hopper outlet, resulting in different residence times which are used for blending. With continuous operation solids are fed constantly or in regular intervals into the blender while the respective quantity is withdrawn via the blending pipes and the hopper outlet. Thus, the filling level remains almost constant. With discontinuous operation the blender is filled successively with different batches. After filling the material within the blender is recirculated or discharged directly. As during discharge the filling level is reduced constantly, solids are withdrawn successively via intake openings at different heights of the individual blending pipe compartments. Only at the start of the homogenization process a quantity of approx. 15% of the blender content has to be recirculated as mainly bulk solids with the same composition can be found in the discharge cone, the blending chamber and in the lower area of the blending pipes. **Advantages** Zeppelin Multi-Pipe Gravity Blenders are applicable for different filling levels up to approx. 25%. Design of the hopper for mass flow guarantees good homogenization results. Zeppelin Multi-Pipe Gravity Blenders can be used either continuously or for batch-wise blending. For many applications the homogenizing effect of one single pass is satisfactory due to the high number of discharge points. Thus, the recirculation via an external pneumatic conveying system will, therefore, only be necessary for a very high degree of homogeneity or extremely wide fluctuations of product quality.

Blending Silos

Multi-Pipe (Gravity Blender)

Material: EN AW 5754 (AlMg3)
Silo configuration: Roof slope 15°, hopper with 50° angle of discharge
Standard accessories: 6 nozzles with blind flanges in the roof for blending pipes
1 set of lifting lugs
All dimensions in mm

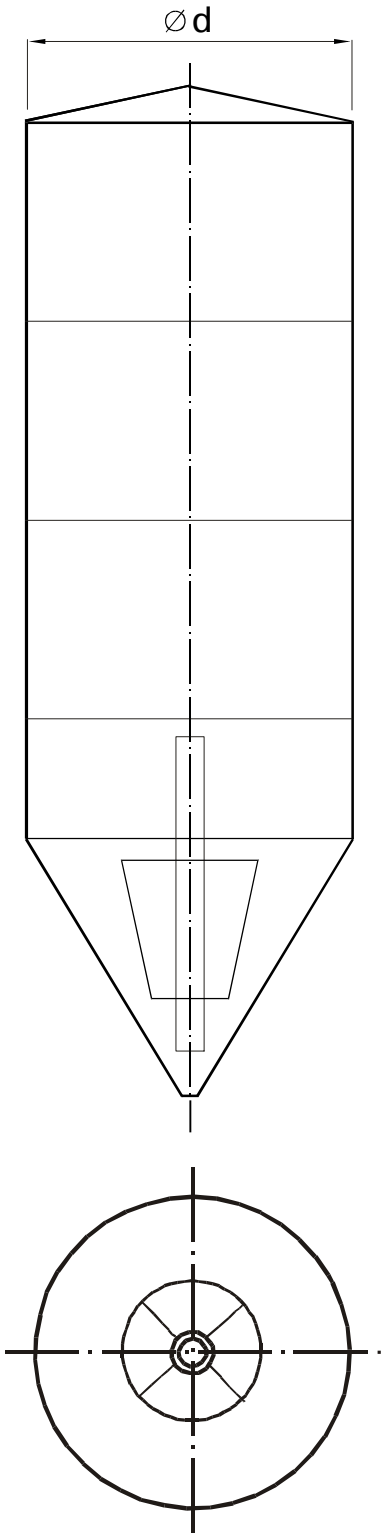


If you cannot foresee a silo of a standard diameter due to building constraints or other reasons, please consult us. In such cases, we are able to supply suitable products.

Silo Type MP (with short skirt)	Silo dimensions			Price code
				Bulk density 6 kN/m3
	d = 2000			**Type MP-20-5-6**
	18 m³	b = 6250	h = 9000	MP2056 018
	d = 2200			**Type MP-22-5-6**
	25 m³	b = 7500	h = 10250	MP2256 025
	d = 2400			**Type MP-24-5-6**
	30 m³	b = 7500	h = 10500	MP2456 030
	45 m³	b = 10000	h = 13000	MP2456 045
	d = 2800			**Type MP-28-5-6**
	50 m³	b = 8750	h = 12150	MP2856 050
	d = 3000			**Type MP-30-5-6**
	70 m³	b = 10000	h = 13600	MP3056 070
	100 m³	b = 13750	h = 17350	MP3056 100
	d = 3500			**Type MP-35-5-6**
	100 m³	b = 10000	h = 14150	MP3556 100
	125 m³	b = 12500	h = 16650	MP3556 125
	150 m³	b = 15000	h = 19150	MP3556 150
	d = 4000			**Type MP-40-5-6**
	160 m³	b = 12500	h = 17200	MP4056 160
	180 m³	b = 13750	h = 18450	MP4056 180
	200 m³	b = 15000	h = 19700	MP4056 200
	d = 4200			**Type MP-42-5-6**
	200 m³	b = 13750	h = 18650	MP4256 200
	250 m³	b = 17500	h = 22400	MP4256 250
	d = 4500			**Type MP-45-5-6**
	250 m³	b = 15000	h = 20250	MP4556 250
	300 m³	b = 18750	h = 24000	MP4556 300
	d = 5000			**Type MP-50-5-6**
	360 m³	b = 17500	h = 23250	MP5056 360
	400 m³	b = 20000	h = 25750	MP5056 400
	d = 6000			**Type MP-60-5-6**
	525 m³	b = 17500	h = 24350	MP6056 525
	600 m³	b = 20000	h = 26850	MP6056 600

Blending Silos

Multi-Flow Blender

	Product description
	**For homogenizing batches or production-related variations of pellets and powders. Easy to retrofit to existing storage silos.** **Description** The blending effect of the ZEPPELIN Multi-Flow Blender is achieved by the installation of a blending hopper resulting in different flow velocities and, thus, in different residence times of the bulk solids. Multi-Flow Blending Silos are most advantageous if the ratio of their height to the diameter is less than 2,5. **Design** Multi-Flow Blending Hoppers can be welded into silos during fabrication. Optionally existing silos can be retrofitted with the hopper. For retrofitting the hopper can be subsequently welded or flange-mounted to the silo. The Multi-Flow Blending Hopper is designed for mass flow ensuring an optimum blending result and complete discharge of the silo. For support of the hopper plane vertical ribs are used which facilitates cleaning of the silo. **Operation** The Multi-Flow Blender is suitable for continuous operation as well as for discontinuous, batch-wise operation. The blending process can optionally be improved by external recirculation. In most cases for homogenization of batches one single pass is sufficient. If the ratio of the silo height to the silo diameter is very small and if only a few batches shall be homogenized recirculation should be foreseen. **Advantages** The ZEPPELIN Multi-Flow Blending Hopper offers you the following advantages: Easy and quick method to retrofit existing silos Good blending results due to a wide residence time distribution and due to mass flow Easy cleaning due to no additional internal installations in the blending hopper Favorable solution for blending of bulk solids

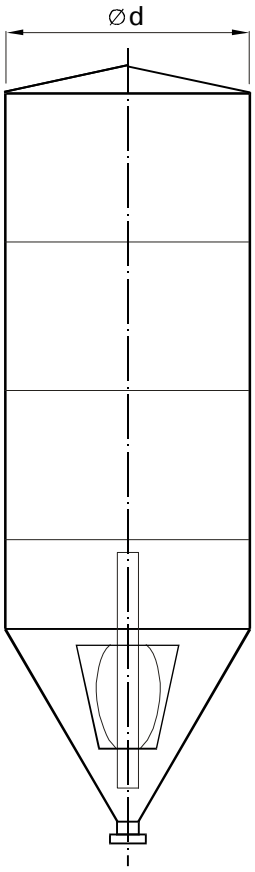
Blending silos

Multi-Flow Blender

Material: EN AW 5754 (AlMg3) or stainless steel
Bolting for flanges: stainless material

Configuration: 50/60°-mass flow hopper
Blending cone with central pipe
Vertical support ribs

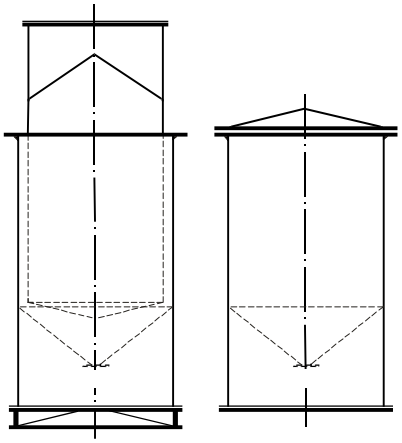
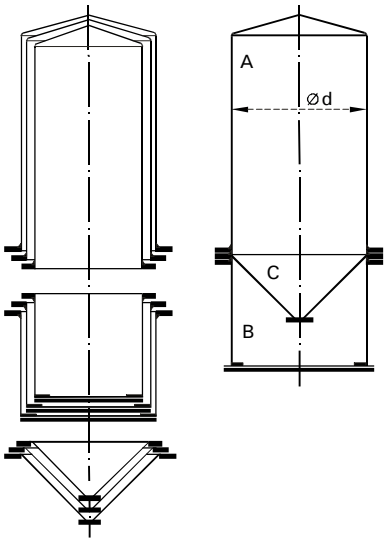
All dimensions in mm

Silo type MF	Blending hopper dimensions	Price code
	Hoppers for welding to the silo during fabrication	
	d = 2400	**MFE2400**
	d = 3000	**MFE3000**
	d = 3500	**MFE3500**
	d = 4200	**MFE4200**
	Hopper for flanging to the silo flange	
	d = 2400	**MFF2400**
	d = 3000	**MFF3000**
	d = 3500	**MFF3500**
	d = 4200	**MFF4200**
	Hopper for retrofitting existing silos by welding (without flange connection)	
	d = 2400	**MFS2400**
	d = 3000	**MFS3000**
	d = 3500	**MFS3500**
	d = 4200	**MFS4200**
If you cannot foresee a silo of a standard diameter due to building constraints or other reasons, please consult us. In such cases, we are able to supply suitable products.	Standard dimensions are based on the design for free flowing bulk solids with a density of the bulk solids up to 6 kN/m³, a wall friction angle ≥ 20 ° and a design temperature of 60° C.	

Storage silos

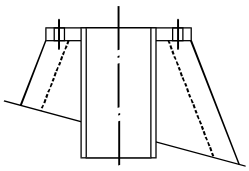
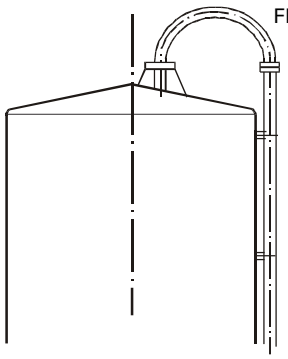
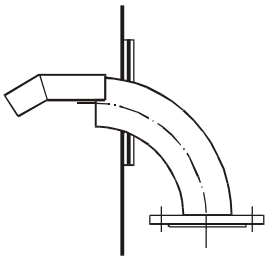
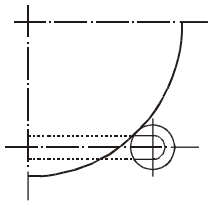
Emboxable version
(efficient method for transportation)

Material: EN AW-5754 (AlMg3)
Silo configuration: Roof slope 15°, hopper with 60°/90° angle of discharge
Standard accessories: 1 set of lifting lugs
All dimensions in mm

	Product description
Two silos in emboxable version  Serveral silos in emboxable version  	**Utilization** For several (at least two) silos of equal or similar size. **System description** ZEPPELIN emboxable silos are manufactured with minor differences in diameter (difference 50-100 mm) and are equipped with a flange connection at the transition between the cylinder and the hopper respectively roof. This method allows to embox the cylinders, hoppers, and skirts of a silo group into each other for transportation. In case of increased requirements for dust density and gas density we recommend a density welding at the flange connection after installation on site. **Accessories** Accessories which protrude more than 25 or 50 mm from the silo wall and which shall be fitted to the silo cylinder are delivered in screwed execution for installation on site. This method can only be realized thanks to the exact manufacture of ZEPPELIN emboxable silos in vertical position. **Calculation** The silo size is stipulated based on the minimum volume of the smallest silo or on the average volume of the silo group. The number of ZEPPELIN emboxable silos per transport package depends on the max. permissible package weights. **Transport** For transport of the packages are put on wooden saddles or wooden supports depending on the requirements. For overseas transport the open front surface at the cylinder is sealed with wooden covers. The accessories are stowed inside the packages during transport. For transport the hopper cones will be fixed to the flange of the cylindrical silo shell or stowed in the dead space inside the skirt (depending on the length and weight of the packages). **Assembly** On site the emboxable silo parts (skirts respectively hoppers with short skirts and silo cylinders) are deboxed. The skirts are lifted onto the foundation base rings. The flange connections are bolted together. For the silo erection normally one crane is required. An additional fork-lift truck will be required to dismount the components of a package. **Advantages** Considerable reduction of the total volume required for transportation over far distances respectively overseas (e.g. for the transport of two emboxable silos approx. 45% of the normally required shipping volume can be saved, for the transport of six silos approx. 80% can be saved) whereas the optical quality of the silos is not deteriorated. Quick and easy erection of the silos (the erection will take approx. 4 h per silo if it is carried out by 3 skilled workers).

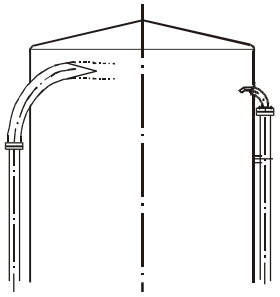
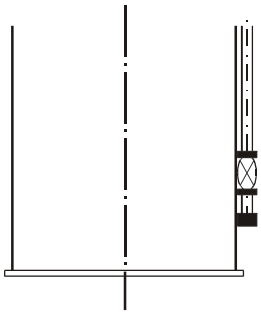
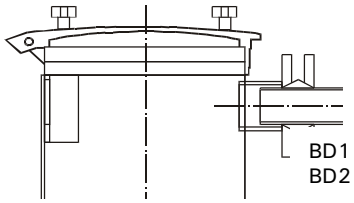
Silo accessories

Silo filling

	Designation	Price code
 L3 L4 L5	**Filling via silo roof** **Filling nozzle** made from aluminium, PN 10 for mounting to the silo roof, with reinforcing ribs **DN 80** (for filling pipe elbow FB1) **DN 100** (for filling pipe elbow FB2 and FBS1) **DN 125** (for filling pipe elbow FBS2)	 **L3** **L4** **L5**
 FB1, FB2 FBS1, FBS2 R8 R10	**Filling pipe with top elbow** made from stainless steel 1.4541, elbow 180°, R = 600 or 1000 mm, flanges PN 10 with gasket and bolts, connection to filling pipe by loose flange **DN 80** loose flange at connection to the filling nozzle **DN 100** loose flange at connection to the filling nozzle **DN 80** fixed flange at connection to the filling nozzle **DN 100** fixed flange at connection to the filling nozzle	 **FB1** **FB2** **FBS1** **FBS2**
 L15 L16	**Filling nozzles mounted laterally to silo shell** **Filling nozzle** made from stainless steel 1.4541, PN 10 elbow 90°, R 5 d, with internal deflector plate, radial mounting to silo shell **DN 80** **DN 100**	 **L15** **L16**
 L31 L32 L33 L34	**Filling nozzle** made from aluminium tangentially mounting to silo shell, with elbow 90°, R = 1000 mm, flange joint PN 10 and deflector plate **DN 80** **DN 100** **Filling nozzle** made from stainless steel 1.4541, PN 10 tangential mounting to silo shell, elbow 90°, R = 1000 mm, with deflector plate **DN 80** **DN 100**	 **L31** **L32** **L33** **L34**

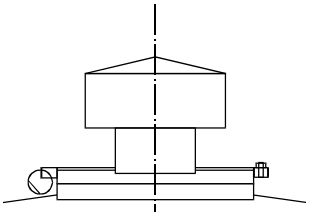
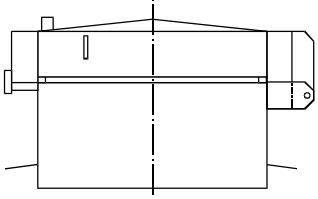
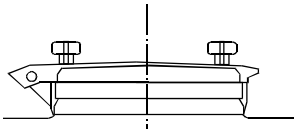
Silo accessories

Silo filling

	Designation	
L31 L32 L33 L34 L15 L16  R8 R10	**Filling pipe** made from aluminium, with connecting flange PN 10 at top, with vehicle coupling or flange joint at the bottom, inclusive of pipe brackets and U-bracket screws **DN 80** **DN 100** **Limit switch** for the vehicle coupling	 **R8** **R10** **RE**
 R8 R10 QV8 QV10	**Squeezing valve** with electric-pneumatical controls comprising: pressure reducing valve with pressure gauge 3/2-port-solenoid valve (non-charged open circuit) Power supply unit 24 V DC Quick-action ventilating valve Sound absorber **DN 80** **DN 100**	 **QV8** **QV10**
 BD1 BD2	**Filling dome** made from aluminium with horizontally positioned connecting flange PN 10 and aluminium deflector. Complete with roof inspection hole DN 500 **DN 80** **DN 100**	 **BD1** **BD2**

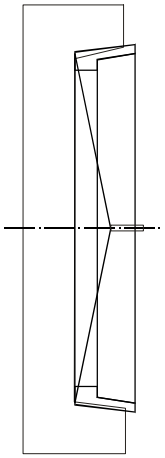
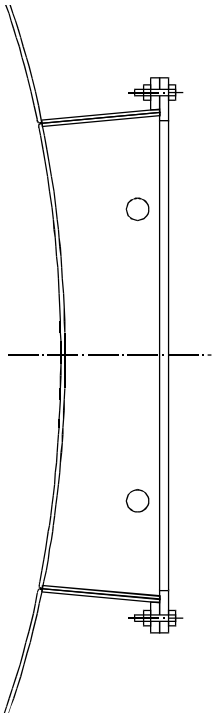
Silo accessories

Roof inspection holes and roof manholes

	Designation	
 ME5	Roof inspection hole* Combined with weld mounted vent nozzle DN 200 **DN 500**	**ME5**
 ME6	Roof inspection hole* Combined with swivel-type ventilation hood (open cross-section 0,10 m^2) and integrated safety grid **DN 600**	**ME6**
 M5	Roof inspection hole * with integrated safety grid **DN 500** **DN 600**	 **M5** **M6**
 M6 M8	Roof manhole with srew-mounted cover and integrated safety grid **DN 600** **DN 800**	 **M6** **M8**
	Padlock for ME and M.	**VS10**
	* Permitted in the Federal Republic of Germany only as an access opening for assembly oprations but not as a manhole for operational access according to the German accident prevention regulations UVV/VBG 112.	

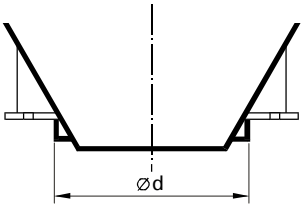
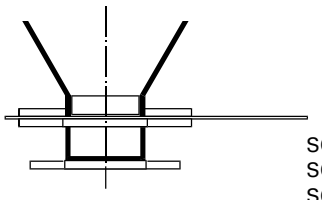
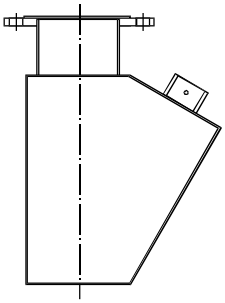
Silo accessories

Shell access openings and manholes

	Designation	
 M7 M7A	Access opening* with cover opening inwards **DN 600**	**M7**
	Access opening* with cover opening inwards and deflector plate to prevent deposits of product on the manhole **DN 600**	**M7A**
 MV5 MV6	Access opening* with deflector to avoid product deposits. The deflector is bolted to the manhole cover, so that the manhole can be completely removed when the silo is empty. **DN 500** **DN 600**	**MV5** **MV6**
	* Permitted in Germany only as an access opening for assembly operations but not as a manhole for operational access complying with German accident prevention regulations UVV/VBG 112.	

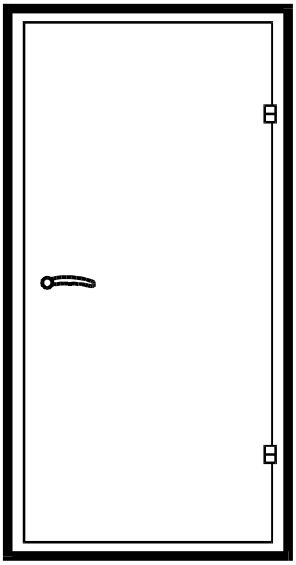
Silo accessories

Product discharge fittings

	Designation	Price code
 AR12 AR15 AR18 AR21	**Suspension mount** Suspension mount for vibrating bottom sleeves **d ≤ 1250 mm** **d ≤ 1500 mm** **d ≤ 1800 mm** **d ≤ 2100 mm**	 **AR12** **AR15** **AR18** **AR21**
 SC15 SC20 SC25	**Emergency slide valves** Emergency slide valve for pellets. Aluminium frame with CrNi steel slide plate for manual operation, welded to conical bottom, inclusive of connecting flange at the bottom. **DN 150** **DN 200** **DN 250**	 **SC15** **SC20** **SC25**
 AK1 AK2 AK3 AK4	**Vacuum extraction box** Vacuum extraction box for pellets made from aluminium; with connecting flange DN 150, 1 opening DN 80 and clamping flanges optionally d = 60/70/80 for vacuum pipe connection. **1 clamping flange** **2 clamping flanges** **3 clamping flanges** **4 clamping flanges**	 **AK1** **AK2** **AK3** **AK4**

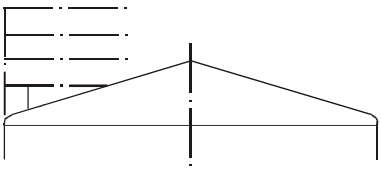
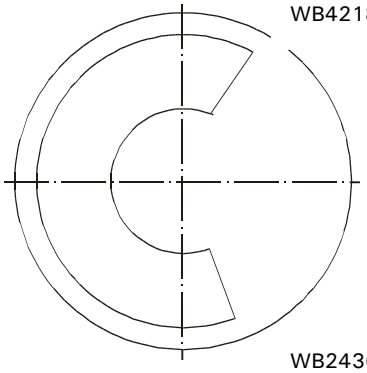
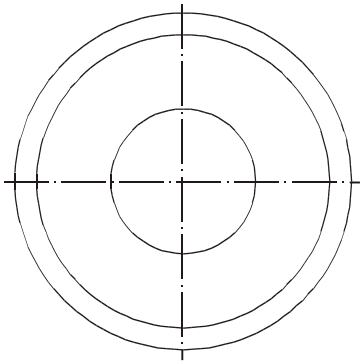
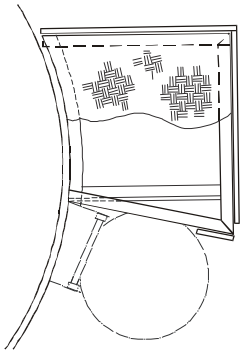
Silo accessories

Skirt doors and openings

	Designation	Price code
 T1 T3 T4	**Doors** Door, lockable, with door knob and reinforcement of skirt in the vicinity of door opening, door optionally with stop at right or left hand side. **850 x 1400 mm** **850 x 1800 mm** **500 x 800 mm**	 **T1** **T3** **T4**
	Large openings in the silo skirt Opening in silo skirt with reinforcement of the silo shell. **850 x 1400 mm** **850 x 1800 mm** **500 x 800 mm**	 **AU1** **AU3** **AU4**
	Openings in the silo skirt **up to 100 x 100 mm** **up to 250 x 250 mm** **up to 500 x 500 mm**	 **DU10** **DU25** **DU50**

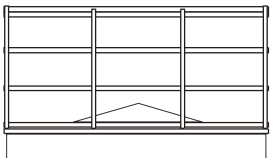
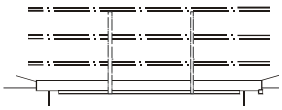
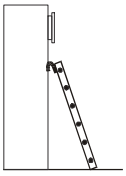
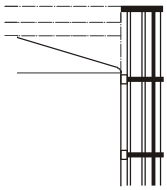
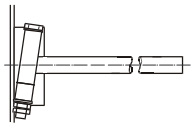
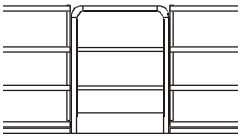
Silo accessories

Maintenance platforms

	Designation	Price code
WB24.. WB30.. WB35.. WB42.. 	**Maintenance platforms** Even/plain maintenance platforms according to DIN 31003, made from checkered aluminium plate, suitable for silo roofs with 15° slope. Platform width: 600 mm.	
WB2418 WB3018 WB3518 WB4218 	Maintenance platforms at 180° **for silo diameter 2400 mm** **for silo diameter 3000 mm** **for silo diameter 3500 mm** **for silo diameter 4200 mm**	 **WB2418** **WB3018** **WB3518** **WB4218**
WB2436 WB3036 WB3536 WB4236 	Maintenance platforms at 360° **for silo diameter 2400 mm** **for silo diameter 3000 mm** **for silo diameter 3500 mm** **for silo diameter 4200 mm**	 **WB2436** **WB3036** **WB3536** **WB4236**
 MP1	**Manhole platform** Manhole platform, made from checkered aluminium plate, with 1200 mm high railing, to be mounted laterally to the silo shell, size 1000 x 850 mm	 **MP1**
	Anti-slip coating For additional safety on a roof with slope angle 15° a anti-slip coating can be rolled out. This coating provides the slippery roof with a rough structure.	 **ASD**

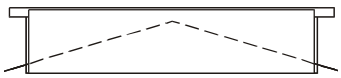
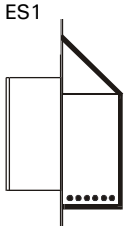
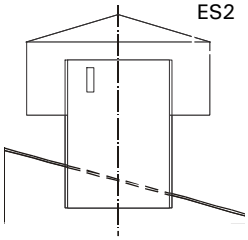
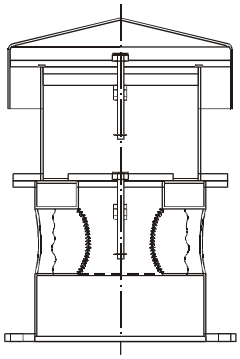
Silo accessories

Access elements

	Designation	
 G24 G30 G35 G42	**Roof railings** Roof railings 1200 mm high (in combination with maintenance platforms WB 1350 mm high), with hand rail and one knee rail and one foot rail inclusive of fastening elements for mounting to silo roof.	
	for silo diameter 2400 mm	**G24**
	for silo diameter 3000 mm	**G30**
	for silo diameter 3500 mm	**G35**
	for silo diameter 4200 mm	**G42**
 B6-B35	**Connecting walkways** Connecting walkway made from checkered aluminium plate, with railings 1200 mm high, 820 mm wide.	
	for distance between silos up to 600 mm	**B6**
	for distance between silos up to 900 mm	**B9**
	for distance between silos up to 1200 mm	**B12**
	for distance between silos up to 1500 mm	**B15**
	for distance between silos up to 2000 mm	**B20**
	for distance between silos up to 2500 mm	**B25**
	for distance between silos up to 3000 mm	**B30**
	for distance between silos up to 3500 mm	**B35**
 UK25 UK30 UK35	**Ladders and rest platform** Ladder without safety cage, with attachment bracket on silo	
	length 2500 mm	**UK25**
	length 3000 mm	**UK30**
	length 3500 mm	**UK35**
 U	Short ladder with safety cage, inclusive of fastening clips to silo.	**U**
	Rest platform for ladders (prescribed for a ladder height of more than 10 m, according to DIN 24532 and German accident prevention regulations UVV)	**RP**
 UR	Attachment brackets for short ladder necessary for further silos (1 pair)	**UE**
	Safety elements Safety hoop as safeguard against falling at top of ladder.	**UR**
 UT	Safety gate as safeguard against falling at top of ladder.	**UT**
	Access barrier for ladder U with padlock.	**US**

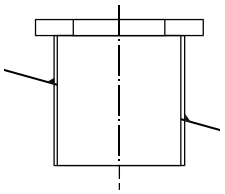
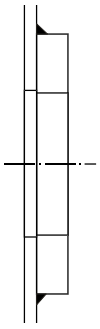
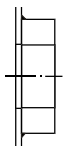
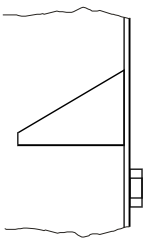
Silo accessories

Filter and vent nozzles, pressure relief valves

	Designation	Price code
 A11 A12 A13 A14	**Filter nozzles** Round filter nozzles, with flange, without gasket and screws, mounted on silo roof **internal diameter 500 - 849 mm** **internal diameter 850 - 1200 mm** Square filter nozzles, with flange, without gasket and screws, mounted on silo roof **internal width 500 - 849 mm** **internal width 850 - 1200 mm** Filter nozzle and silo roof are designed to accommodate a filter weight of 400 kg and wind load caused by a maximum filter height of 1600 mm. For different sizes please contact our sales personnel.	 **A11** **A12** **A13** **A14**
 AB11 AB12 AB13 AB14	**Blind flanges for filter nozzles** Blind flange for round filter nozzle with gasket and screws **for internal diameter 500 - 849 mm** **for internal diameter 850 - 1200 mm** Blind flange for square filter nozzle with gasket and screws **for internal width 500 - 849 mm** **for internal width 850 - 1200 mm**	 **AB11** **AB12** **AB13** **AB14**
ES1   ES2	**Vent nozzle** Vent nozzle with rain collar, mounted to silo roof **DN 200 (Open cross-section 0.02 m²)** Vent nozzle with rain collar, mounted to silo shell **200 x 160 mm (Open cross-section 0.02 m²)**	 **ES1** **ES2**
 DV2	**Pressure relief valve** Pressure relief valve designed for + 45/-5 mbar ± 10% made from aluminium, with rain collar and connecting flange DN 250 PN 10. The valve is not gas-tight. For more detailed information, see leaflet No. DV 2 Appropriate nozzle: C8	 **DV2** **C8**

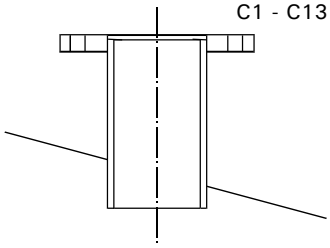
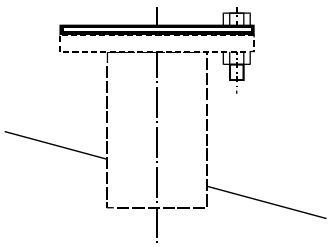
Silo accessories

Nozzles for level indicators

	Designation	
 D2 D3 D4	Nozzles for level indicators **Flange nozzles** Flange nozzles according to DIN 2501, PN 10, without gaskets and bolts **DN 100**	**C4**
	150 x 150 mm / internal diameter d = 100 mm with 4 threaded holes d = 18 on hole circle d = 170	**D2**
	d = 120/70 mm, with 4 threaded holes M 6 on hole circle d = 90	**D3**
	d = 150/70 mm, with 4 threaded holes M 6 on hole circle d = 90	**D4**
 DB2 DB3 DB4	**Block flanges** **150 x 150 mm / d = 120, with 4 threaded holes M 16 on hole circle d = 170**	**DB2**
	d = 120/70 mm, with 4 threaded holes M 6 on hole circle d = 90	**DB3**
	d = 120/70 mm with 4 threaded holes M 8 on hole circle d = 90	**DB4**
 GM ½ GM1 GM1 ½ GM2 GM2 ½	**Threaded sleeve with plastic screw plug** R **½“** R 1" R 1**½“** R 2" R 2**½“**	**GM ½** **GM1** **GM1 ½** **GM2** **GM2 ½**
 SD	**Protective hood** Protective hood for level indicators mounted to the silo shell and the cone.	**SD**

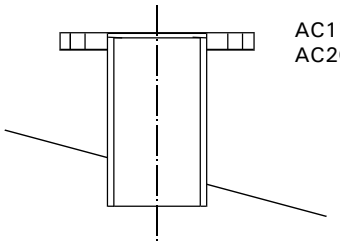
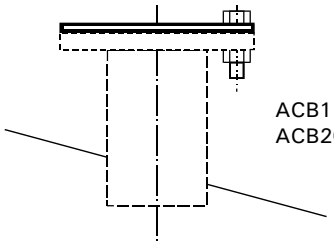
Silo accessories

Nozzles

	Designation	
C1 - C13 	**Flange nozzles** Flange nozzles made from aluminium with connecting dimensions according to DIN 2501, PN 10, without gasket and bolts	
	DN 50	**C1**
	DN 65	**C2**
	DN 80	**C3**
	DN 100	**C4**
	DN 125	**C5**
	DN 150	**C6**
	DN 200	**C7**
	DN 250	**C8**
	DN 300	**C9**
	DN 350	**C10**
	DN 400	**C11**
	DN 450	**C12**
	DN 500	**C13**
CB1 - CB13 	**Blind flanges** Blind flanges made from aluminium for nozzles Type C with gasket and bolts	
	DN 50	**CB1**
	DN 65	**CB2**
	DN 80	**CB3**
	DN 100	**CB4**
	DN 125	**CB5**
	DN 150	**CB6**
	DN 200	**CB7**
	DN 250	**CB8**
	DN 300	**CB9**
	DN 350	**CB10**
	DN 400	**CB11**
	DN 450	**CB12**
	DN 500	**CB13**
	Special types on request.	

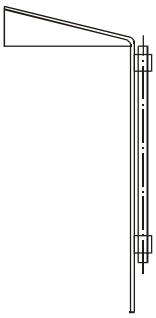
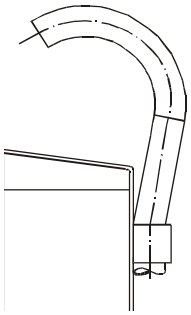
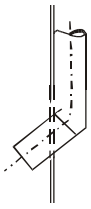
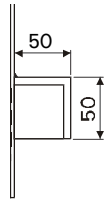
Silo accessories

Nozzles

	Designation	
 AC1" - AC20"	**Flange nozzles** Flange nozzles made from aluminium with connecting dimensions according to ANSI B 16.5 150 lbs/sq.inch, without gaskets and bolts	
	1"	**AC1**
	1 ½“	**AC1½**
	2"	**AC2**
	3"	**AC3**
	4"	**AC4**
	5"	**AC5**
	6"	**AC6**
	8"	**AC8**
	10"	**AC10**
	12"	**AC12**
	14"	**AC14**
	16"	**AC16**
	18"	**AC18**
	20"	**AC20**
 ACB1"- ACB20"	**Blind flange** Blind flanges made from aluminium for nozzle type AC with gaskets and bolts.	
	1"	**ACB1**
	1 ½“	**ACB1½**
	2"	**ACB2**
	3"	**ACB3**
	4"	**ACB4**
	5"	**ACB5**
	6"	**ACB6**
	8"	**ACB8**
	10"	**ACB10**
	12"	**ACB12**
	14"	**ACB14**
	16"	**ACB16**
	18"	**ACB18**
	20"	**ACB20**
	Special types on request.	

Silo accessories

Protective cable conduit/Rain collar

	Designation	
	**Protective cable conduit** Protective cable conduit, complete with brackets, welded vertically to the silo shell, open at top and bottom, not led into the silo skirt	
KS1 KS2 KS3 KS4	**internal diameter = 29 mm** **internal diameter = 50 mm** **internal diameter = 80 mm** **internal diameter = 100 mm**	**KS1** **KS2** **KS3** **KS4**
	Elbow fitting, upper end-section for cable conduit	
KB1 KB2 KB3 KB4	**internal diameter = 29 mm** **internal diameter = 50 mm** **internal diameter = 80 mm** **internal diameter = 100 mm**	**KB1** **KB2** **KB3** **KB4**
	Lead-in aperture for introduction of cable conduit into silo skirt	
KD1 KD2 KD3 KD4	**internal diameter = 29 mm** **internal diameter = 50 mm** **internal diameter = 80 mm** **internal diameter = 100 mm**	**KD1** **KD2** **KD3** **KD4**
	Rain collar	
	Rain collar for insertion under roof flashing	
RK24 RK30 RK35 RK42	**for silo diameter = 2400 mm** **for silo diameter = 3000 mm** **for silo diameter = 3500 mm** **for silo diameter = 4200 mm**	**RK24** **RK30** **RK35** **RK42**

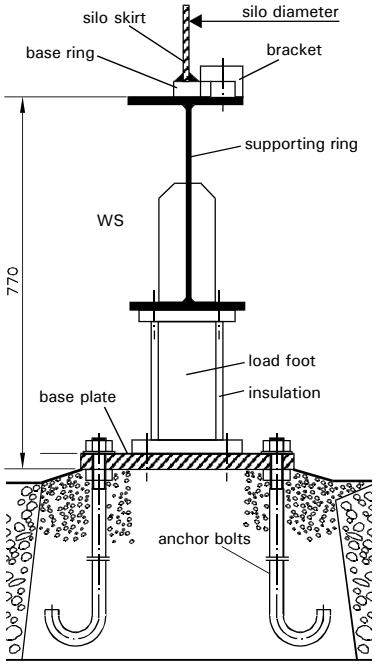
Silo accessories

Filling level control system

	Designation
	ZEPPELIN Filling level control system ZEP-CONTROL **Application** For continuous measurement of the weighing of silos and vessels – Exactly defined display of silo content at any time **Design** The filling level control system consists of a supporting ring made from steel and load cells with integrated intelligent sensors. Evaluation unit for data visualization PC (supplied by customer) runs under digital user surface Microsoft® MS Windows TM. Alternatively a digital display unit with graphics display is available. Anchoring: The system shall be bolted with the supporting ring and the base plate to the concrete foundation. The base plate shall be bolted or welded to the steel frame. The supporting ring shall be connected to the silo skirt with the help of clamping brackets. Functioning of the system The sensors measure the load feet's length which varies depending on the current silo weight. The measurement result is transferred as a digital signal to the evaluation unit by means of a bus system. **Advantages** Continuous measurement – even during the silo filling process Measurement results are stored as electronic data when the PC visualization is used Quantity of the material used can be balanced exactly – even if there are varying bulk solids characteristics, humidity, dust formation and crosswinds of up to 80 km/h. Retrofitting is possible – as well as integration in existing complete installations Supporting ring and silo are statically adjusted to each other.

Silo accessories

Filling level control system



Designation	Price code
Filling level control system ZEPPELIN filling level control system for continuous measurement of the contents of silos (also suitable for retrofitting). Consists of: supporting ring with load feet, sensors and anchor bolts*. * The number of anchor bolts is determined individually by the result of static analysis for the individual loads. System accuracy: ± 1% of max. system weight (G) Supporting ring: St 37, primed Load feet: St 37 insulated Accuracy of load cell: ± 0.25 % in relation to the scale's end value	
Filling level control system with evaluation on digital display Filling level indication on digital display. Digital display unit (per silo)	**DAG**
or **Filling level control system with software for data visualization** Filling level indication on customer's PC with digital user interface Microsoft ® Windows. Bus coupling (per silo) Software (per group of silos max. 20 units)	**PCBK** **FCS**
No. of anchor bolts D = 2400 G = 60 t n = 3 8 D = 2400 G = 80 t n = 4 12	**WS24/ 60** **WS24/ 80**
D = 3000 G = 80 t n = 4 16 D = 3000 G = 100 t n = 6 24 D = 3000 G = 150 t n = 8 32	**WS30/ 80** **WS30/100** **WS30/150**
D = 3500 G = 120 t n = 6 24 D = 3500 G = 250 t n = 8 32	**WS35/120** **WS35/250**
D = 4200 G = 150 t n = 8 24 D = 4200 G = 250 t n = 8 32	**WS42/150** **WS42/250**
G = max. system weight, D = silo diameter, n = number of load feet	
Supporting ring with load feet as above, ring hot-galvanized.	**WS..1/...**
Access element 4-rung ladder on inside and outside of silo, for access to silo skirt.	**WZ9002**

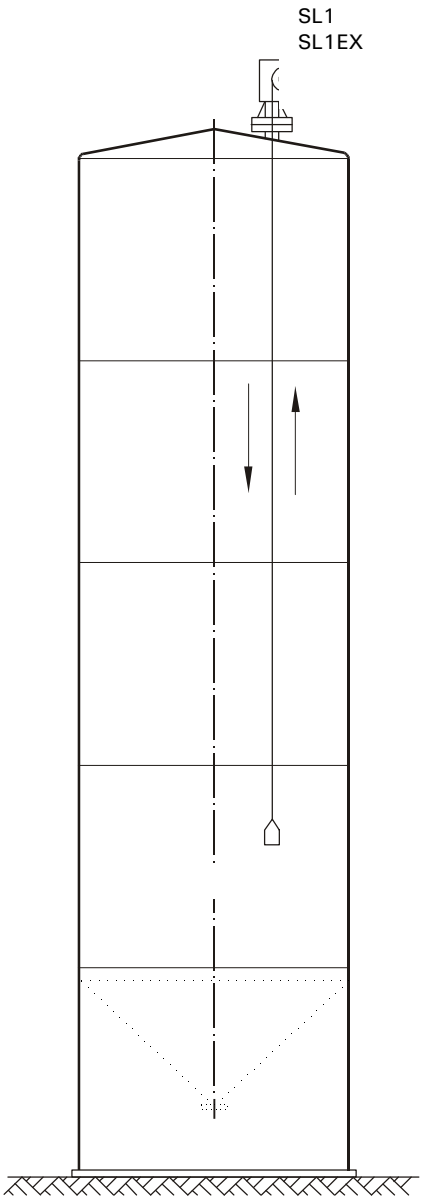
Silo accessories

Switch cabinet

	Designation	Price code
	Switch cabinet with filling level indication, inclusive of equipment for triggering of ultrasonic level measurement or Silot. Level indicator, filling pipe limit switch Inclusive of equipment for triggering of alarm and warning light. One reset button per silo. Display scaled in %, m³ or t.	
	Switch cabinet for 1 silo	**SS1001**
	Switch cabinet for 2 silos	**SS1002**
	Switch cabinet for 3 silos	**SS1003**
	Switch cabinet for 4 silos	**SS1004**
	Switch cabinet for 5 silos	**SS1005**
	Switch cabinet for 6 silos	**SS1006**
	Warning devices	
	Acoustic warning device by alarm (without reset button)	**WZ90011**
	Visual warning device by rotating light or flashing alarm light.	**WZ90012**

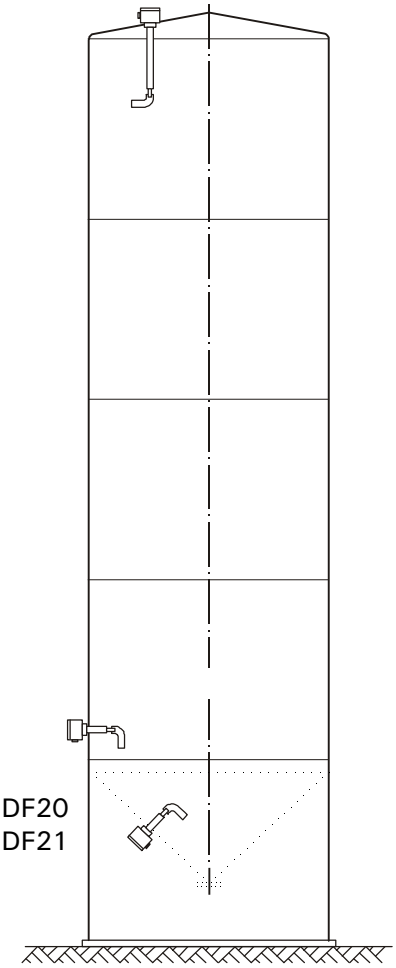
Filling level control equipment

Silot

	Designation	Price code
	**Silot (electromechanical plumbline gauge)** **Fields of application** For virtually continuous indication of the silo contents with granular and heavily dusting bulk solids. **Functional description** A manually operated starting impulse lowers the measuring cable with the contact weight by means of a cable winch. When the weight touches the product, the weight is pulled up again. During this upward movement counting impulses are released after every 10 cm of collected cable length. **Product description** Basic housing and flange made from die-cast aluminium. Flange connection DN 100, PN 16 Measuring cable made from stainless steel Cable protection tube made from aluminium, length 500 mm Weather protection hood made from plastics Contact weight made from PVC Measuring rage max. 30 m, adjusted according to silo filling height Start impulse to be activated manually Integrated heating Operating temperature -20 °C bis + 50 °C With gasket and bolts (only in conjunction with the purchase of a silo) **Electro technical data** Mains voltage 230 V AC, 50 Hz Protection class IP65 Cables not included in the scope of supply. Counting impulses are released as analogous signals (0/4 - 20 mA). **Silot in standard design** **Silot with permission for dust explosion classes 10 and 11** Appropriate nozzle: C4	**SL1** **SL1EX** **C4**

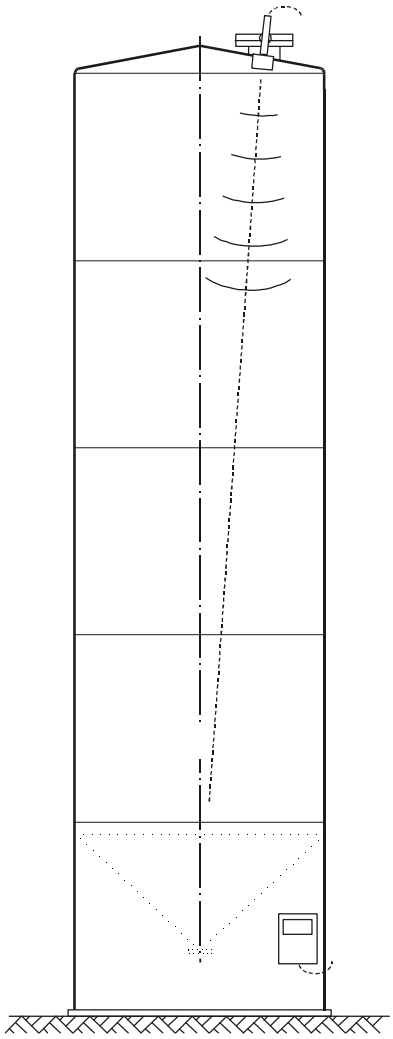
Filling level control equipment

Filling level measuring equipment

	Designation	Price code
DF10 DF11  DF20 DF21	**Rotary paddle type limit switch indicating full level** Rotary paddle type limit switch to be mounted on the silo roof. Housing made from die-cast aluminium, paddle and measuring blade and blade shaft made from stainless steel, protective tube made from aluminium. Shaft length 800 - 1200 mm Connecting thread R 1½", acc. to DIN 228 With protective hood Signal exit potential-free Operating temperature -20 °C to +50 °C Protection class IP65, mains voltage	
	230 V AC, 50 Hz	**DF10**
	24 V DC	**DF11**
	Rotary paddle type limit switch indicating full level With permission for dust explosion class 10/11, mains voltage	
	230 V AC	**DF10Ex**
	24 V DC	**DF11Ex**
	Rotary paddle type limit switch indicating intermediate level or empty status Rotary paddle type limit switch to be mounted in the silo shell or cone. Housing made from die-cast aluminium, paddle and measuring blade and blade shaft made from stainless steel, protective tube made from aluminium. Shaft length 250 mm Connecting thread R 1½", acc. to DIN 228 With protective hood Signal exit potential-free Operating temperature -20 °C to +50 °C Protection class IP65, mains voltage	
	230 V AC, 50 Hz	**DF20**
	24 V DC	**DF21**
	Rotary paddle type limit switch indicating intermediate level or empty status with permission for dust explosion class 10, mains voltage	
	230 V AC	**DF20Ex**
	24 V DC	**DF21Ex**
	Appropriate threaded nozzle: 1 ½"	**GM1½**

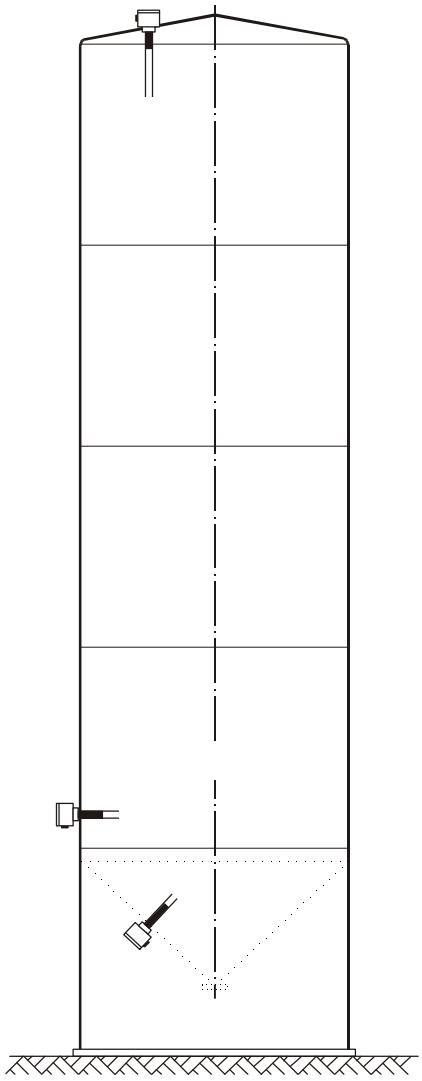
Filling level measuring equipment

Ultrasonic level measurement

	Designation	Price code
US10 US15 US10S US15S 	**Ultrasonic measuring device** **Fields of application** To be used in touch-free and continuous filling level measuring systems for granular and only lightly dust-producing bulk solids. **Functional description** A sensor emits ultrasonic waves. When the waves hit on the bulk solid, part of them is reflected and picked up again by the sensor. The evaluation device transfers the measuring results into an analogous (0/4 - 20 mA) output signal. **Product description** The sensor is separated from the evaluation device. The evaluation device possesses an integrated control and display panel. The sensor is situated on a swiveling support, flange DN150, adjustably mounted. **Measuring range** Beginning at 1m from sensor (block distance), ranging to a silo filling height of up to 15 m. **Electro-technical data** Connecting cable between sensor and evaluation device 2 wires The scope of supply comprises 20 and/or 25 m length of cable Distance between the sound transformer and the evaluation device max. 300 m. Exit signal 0/4 – 20 mA for continuous filling level measurement Relay exit for intermediate level indication Mains voltage: **16 - 42 V AC** **16 - 60 V DC** **90 - 250 V AC** **120 - 250 V DC** Appropriate nozzle for ultrasonic sensor: C6	**US10** **US15** **US10S** **US15S** **C6**

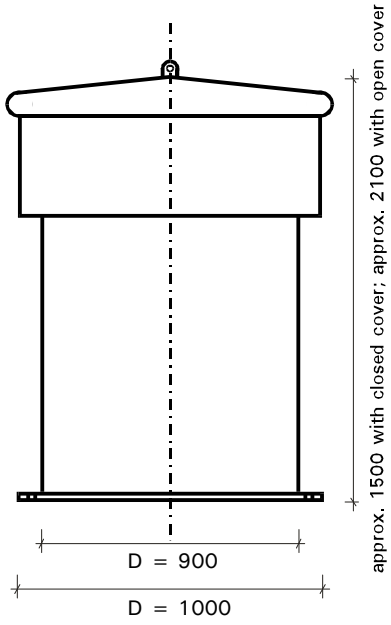
Filling level measuring equipment

Limit level measuring device

	Designation	Price code
VG10/... VG10EX/... 	**Vibration limit switch as level indicator indicating full level** **Vibration limit switch** **(System of protection IP 65)** Housing made from die-cast aluminium Extension arm made of stainless steel Connection thread R 1½", cone-shaped according to DIN 2999 With protective hood Operation temperature -20 °C to +50 °C Overcharge protection because of full level indication in case of power failure or line break Mains voltage 19 - 253 V AC / 19 - 60 V DC Protection class IP65 Signal output potential-free For mounting on silo roof Length of extension arm **800 mm** **1000 mm** **1200 mm**	 **VG10/80** **VG10/100** **VG10/120**
	Vibration limit switch with permission for StEX-zone 10 and 11 **800 mm** **1000 mm** **1200 mm**	 **VG10EX/80** **VG10EX/100** **VG10EX/120**
VG20/235 VG20EX/235	**Vibration limit switch indication empty status or intermediate level** Housing made from die-cast aluminium Extension arm made of stainless steel Connection thread R 1½", cone-shaped according to DIN 2999 With protective hood Operation temperature -20 °C to +50 °C Overcharge protection because of full level indication in case of power failure or line break Mains voltage 19 - 253 V AC / 19 - 60 V DC Protection class IP65 Signal output potential-free For mounting in silo skirt or silo cone. Length of extension arm **235 mm**	 **VG20/235**
	Vibration limit switch with admission for dust explosion classes 10 and 11 **235 mm**	 **VG20EX/235**
	Appropriate threaded sleeve: R 1½"	**GM1½**

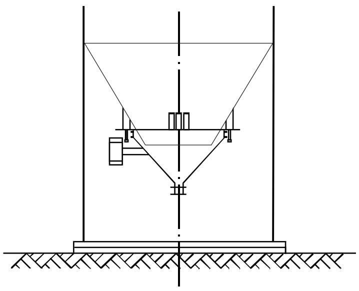
Filters

Filter on silo roof

	Designation	Type
	**Filter on silo roof** Body and cover made completely from aluminium, weight only 100 kg**.** Filters for installation on silo roof with automatic cleaning device for compressed exhaust air, designed to fill tank vehicles (pipe diameter DN80 or DN100) or to be used in the continuous conveying process. Filters for installation on silo roof with automatic cleaning device for compressed air 4 different filter materials are available for different bulk solids. Housing, weather protection hub, compressed air supply tank and all parts in contact with the product are made from aluminium. Control panel can easily be reached from outside and can be adjusted individually. Cleaning valves (permitted for the dust explosion class 11) with integrated sound absorber	**FG**
	Assembly material Bolts, nuts, washers made from stainless steel Gaskets made from Neoprene, light Compressed air supply G: ½'' Compressed air hose: approx. 3 m 4 pipe brackets made from stainless steel	
	Filter control unit The circuit switch of the filling pipe coupling emits a signal to the filter control unit to start the cleaning process The cleaning takes place during operation. All pre-settings can be adjusted to the specific requirements at anytime. Mains voltage	
	230 V AC	**FST10**
	24 V DC	**FST11**
	Filter cartridges Each equipped with adapter ring, support cage and reflector. Filter material 100 % polyester, thermally bound, recyclable, Heat resistant to max. 100 °	
	Set of filter cartridges, filter area 16 m^2	
	Standard	**FP1601**
	Anti-static	**FP1602**
	PTFE-Membrane	**FP1603**
	PTFE-Membrane and anti-static	**FP1604**
	Set of filter cartridges, filter area 24 m^2	
	Standard	**FP2401**
	Anti-static	**FP2402**
	PTFE-Membrane	**FP2403**
	PTFE-Membrane and anti-static	**FP2404**
	Appropriate filter flange	**FG9**

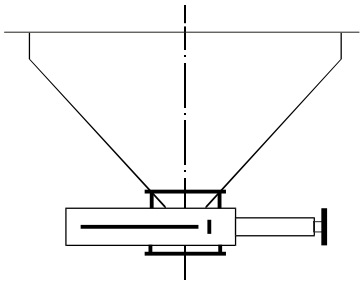
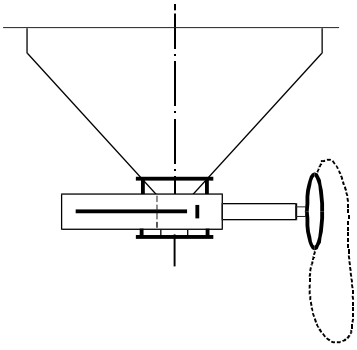
Product discharge

Vibrating bottom

	Designation	Price code
VB....CS VB....SS 	The vibrating bottom serves to discharge bulk solids, which are not free-flowing. The vibrating bottom is attached at several points and suspended below the silo cone, so that one or more unbalance engine(s) can set him to vibrate. The vibrations are transferred to the product in the silo cone and enable the bulk solid to be discharged. The engine speed of the unbalanced engine is already pre-set when delivered and has to be adjusted only in exceptional cases. The transition of the silo cone to the vibrating bottom is perfectly sealed by means of an extruded special gasket, which is clamped between flanges. **Equipment:** Main gasket in U form with two clamp flanges Discharge gasket to the subsequently connected device Fixing device Outlet, Outlet diameter DN 200 - 400 PN10	
	Vibrating bottom made of steel with epoxy-coating, nominal diameter	
	600 mm	**VB0600CS**
	900 mm	**VB0900CS**
	1250 mm	**VB1250CS**
	1500 mm	**VB1500CS**
	1800 mm	**VB1800CS**
	2100 mm	**VB2100CS**
	Vibrating bottom made of steel with epoxy coating, nominal diameter	
	600 mm	**VB0600SS**
	900 mm	**VB0900SS**
	1250 mm	**VB1250SS**
	1500 mm	**VB1500SS**
	1800 mm	**VB1800SS**
	2100 mm	**VB2100SS**
	Appropriate suspension arrangement : AR12 - AR21	**AR..**

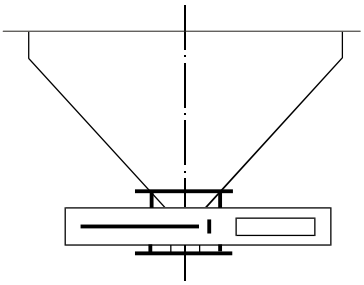
Discharge control/stopping units

Slide valve

	Designation	Price code
	Slide valve for bulk solids For securely shutting off, dosing and separating of dry, free-flowing bulk solids, such as dust (min. 10 μ). Can also be used with granulates to a size of max. 6 mm. Robust and compact construction in low overall height, dust-tight opening area. Casing made from die-cast aluminium. For closing the slide plate cuts directly into the product. Slide plate is bevelled at the face with an angle of 30° and consists of a product deflector. The slide valve's guiding can be adjusted by means of sliding cams via the eccentric. Gasket is directed to the outside with a white, oil-free stuffing box gasket. Fully flanged fitting with flange boring according to DIN 2501, PN 10 or ANSI B 16.5 150 lbs/sq. inch (all borings with thread, depth of thread 25 mm)	
AS15-30 A 	Operated by a hand-wheel (can be retrofitted to a reel) Rated size **DN 150** **DN 200** **DN 250** **DN 300**	 **AS15A** **AS20A** **AS25A** **AS30A**
AS15-30 B 	Actuation with reel and 4 m chain, Rated size **DN 150** **DN 200** **DN 250** **DN 300**	 **AS15B** **AS20B** **AS25B** **AS30B**

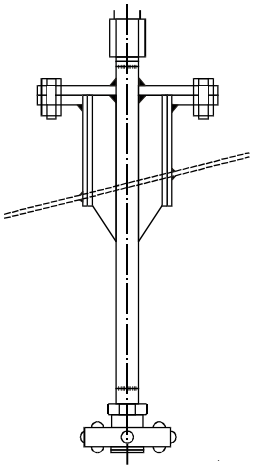
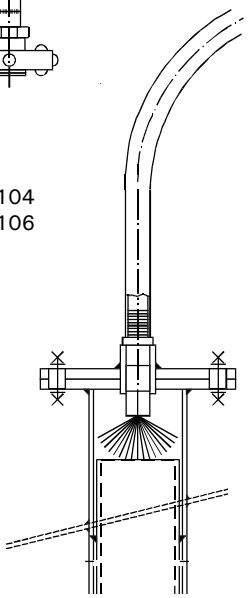
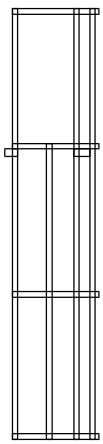
Discharge control/stopping units

Slide valve

	Designation	Price code
AS15-30 C 	**Pneumatically controlled slide valve for bulk solids** Complete with terminal box, solenoid valve and limit switches wired on a terminal strip. There are 3 entries and 2 connections for the supply line available. 2 limit switches (ON/OFF), output voltage 24 V DC, mark Pepperl & Fuchs, Type NBB5-18GM50E2 Solenoid valve G ¼“, 24 V DC, mark Herion Valve connector with blow-out diode With quick-action ventilating valve G 3/8“ Air consumption 3 - 8 bar compressed air, oilfree and dry Time required for closing < 1 sec. Slide valve, pneumatically activated, Rated size **DN 150** **DN 200** **DN 250** **DN 300**	**AS15C** **AS20C** **AS25C** **AS30C**

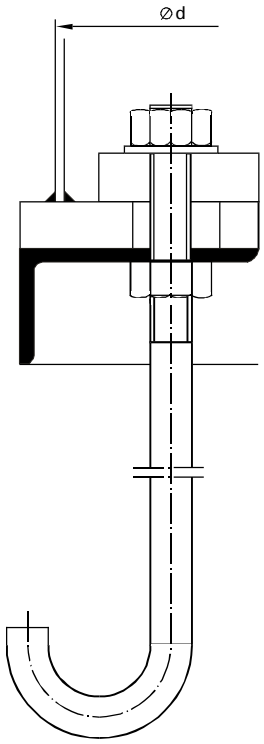
Special silo accessories

Washing systems

	Designation	
 WS1003 WS1005	**Silo washing systems** Silo washing system, comprising washing nozzle with welded cleaning head and ¾'' connecting nipple. Washing nozzle with cleaning head for a connected pressure of 3 - 5 bar, an **effective range of up to 3000 mm diameter and a water consumption of 70 - 90 l/min**	**WS1003**
	effective range of up to 5000 mm diameter and a water consumption of 200-250 l/min	**WS1005**
 WS1104 WS1106	**Blending silo washing systems** Blending silo washing system, comprising washing nozzle with screw-mounted cleaning heads and ring pipe a connecting nozzle DN80 or DN100 on silo roof for a connected pressure of 3 – 5 bar, adequate for **Blending silo diameters of up to 4200 mm and a water consumption of approx. 400 - 650 l/min**	**WS1104**
	Blending silo diameters of up to 6000 mm and a water consumption of approx. 600 - 750 l/min	**WS1106**
	Blending silo washing system as supplement to WS11, comprising 6 cleaning nozzles with screw-mounted washing nozzles connected to the ring pipe WS11. Blending silo washing system with a water consumption of 180 – 220 l/min and a connected pressure of 3 – 5 bar.	**WS20**
 EK	Access cage for manhole M8 facilitates cleaning of interior of silo with a hose. Access depth approx. 2.2 m.	**EK**

Silo accessories

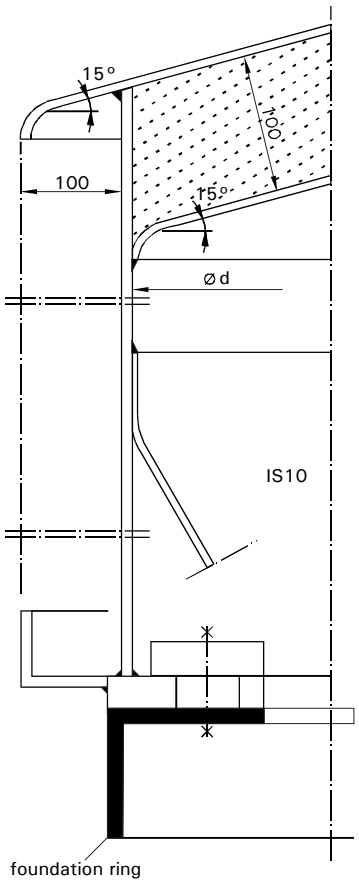
Anchoring



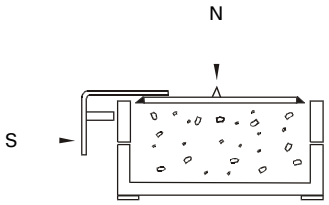
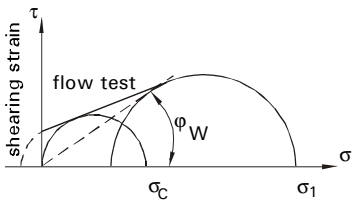
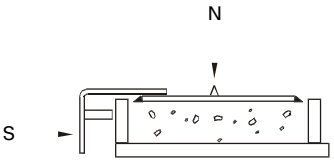
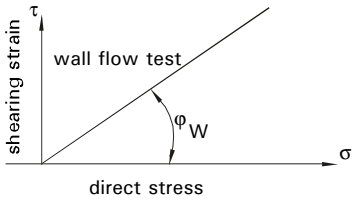
Designation					Price code
Silo mounting to a concrete foundation					
Foundation base ring made from St 37 with pre-installed anchor bolts, pressure plates, nuts and washers. The base ring is delivered in advance in two parts for casting with concrete. The ring elements are delivered unpainted. We recommend to paint all exposed surfaces after installation.					
				No. of Anchors	
d = 2400	F24	25 - 48	m³	12	**F2412**
	F24	70	m³	24	**F2424**
d = 3000	F30	35 - 75	m³	12	**F3012**
	F30	80 - 110	m³	24	**F3024**
	F30	125	m³	32	**F3032**
	F30	140 / 150	m³	48	**F3048**
d = 3500	F35	45 - 100	m³	12	**F3512**
	F35	110 - 150	m³	12	**F3524**
	F35	154 - 173	m³	12	**F3532**
	F35	190 - 197	m³	12	**F3540**
	F35	214 - 221	m³	12	**F3552**
	F35	238 - 245	m³	12	**F3568**
d = 4200	F42	93 - 140	m³	12	**F4212**
	F42	162 - 208	m³	24	**F4224**
	F42	231 - 243	m³	32	**F4232**
	F42	266 - 312	m³	48	**F4248**
Foundation base ring as above but with hot-galvanized ring, anchors and pressure plates.					**FZxxxx**
Silo mounting on steel frame					
Template for drilling holes in silo base ring and steel, sub-frame, delivered in two parts with screw fasteners, made from St 37.					
for silo diameter 2400 mm					**SB24**
for silo diameter 3000 mm					**SB30**
for silo diameter 3500 mm					**SB35**
for silo diameter 4200 mm					**SB42**
Anchor rack steel construction					**M24x100**
Shear connector tight anchoring					**VA24**
Earthing boss					**EL**

Silo accessories

Silo insulation

	Designation	
	**Silo insulation** Silo pre-configured for insulating jacket to be mounted on site, comprising accessible, double-skin silo roof, insulated with 100 mm mineral wool, roof overhang and, supporting ring flange to fasten the insulation mats and cladding panels when silo is assembled. **for silo diameter 2400 mm** **for silo diameter 3000 mm** **for silo diameter 3500 mm** **for silo diameter 4200 mm** Silo shell insulated with mineral mats 100 mm thick and with 1 mm aluminium sheet. Price per m² Insulation for silo accessories on request.	 **IS1024** **IS1030** **IS1035** **IS1042** **S1100**

Determination of Bulk solids characteristics

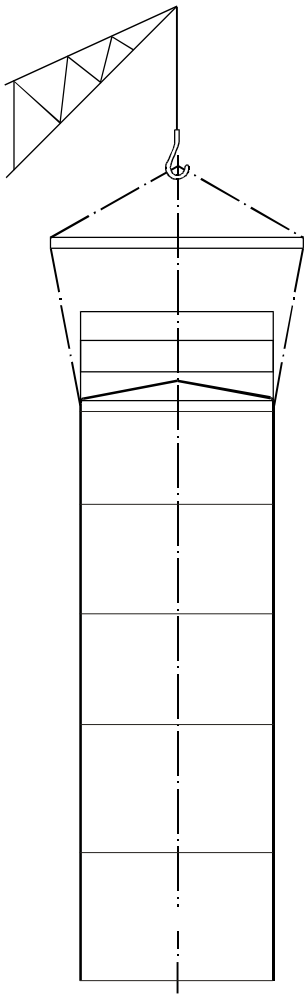
	Designation	Price code
	Determination of bulk solids characteristics	
	Standard series of trials to determine the flow characteristics of bulk solids. The trials provide for the measurement of - 3 flow tests for different densities of bulk solids - 1 wall flow test to determine the wall friction. The evaluated test results are incorporated in a final report, together with the configuration data for the silo required.	**SV01**
	Tests for consolidation over time The storage of bulk solids under compaction pressure, which occurs between withdrawals, can effect flowability through time consolidation over a period of time, particularly in the case of adherent bulk solids. The tests provide for the determination of consolidation over time for four storage periods up to max. 120 h, including the evaluation of the results for the silo configuration (in conjunction with SV01)	**SV02**
	Configuration data for the silo static calculation Determination of the different bulk solids data according to DIN 1055, part 6, from shear tests and bulk solids comparisons.	**SV03**
	Shortened series of tests to determine the configuration of a bulk flow silo for free-flowing bulk solids, comprising: - 1 flow test - 1 wall flow test - Configuration for a bulk flow silo.	**SV04**
	Determination of additional wall flow test for alternative silo wall materials. Trials at higher temperatures, particularly for the determination of consolidation over time, can be carried out but involve high costs and should only be performed with consideration for the results obtained from trials at room temperature. The specified prices are subject to the provision that the test are carried out with non-toxic, non-hygroscopic bulk solids, under ambient conditions. For the trials, a representative sample, consisting of at least 5 liters of the bulk material concerned, must be made available (the costs of return carriage and/or disposal of the test material to be borne by the customer). Product samples must be accompanied by a completed safety specification, complying with DIN 52900.	**SV05**

Quality certificates

Documentation

	Designation	
	Quality certificates	
	Quality certificates for butt-welded seams on silos	
	X-ray testing	**QN01**
	Nekal air test with suction bell	**QN02**
	Quality certificates for fillet-welded seams on silos	
	Dye-penetration test	**QK**
	Documentation	
	Preparation of individual documents for the client, which are not ZEPPELIN standard:	
	Welding plan	**DO1**
	Welding process tests	**DO2**
	Welders' certificates	**DO3**
	Test schedule	**DO4**
	Test sequence schedule	**DO5**
	Revision of Zeppelin standard drawings according to customer's specifications.	**DZ1**
	Static calculations	
	Static calculation of a standard silo.	**ST1**

Silo Assembly

	Designation	Price code
	**Assembly** We will carry out the complete assembly of silos or provide the services of supervisors or skilled assemblers on request. As a rule, the assembly operation breaks down into the following stages: 1. Offloading of the silo and accessories from the wagon or transport vehicle with a mobile crane. 2. Transfer from the offloading siding to the construction site with a crane or low-loader. 3. Screw-mounting of the ladder and filling pipe to the appropriate silo. 4. Levelling up the foundation base rings. 5. Setting the silos upright and placing them on their base rings 6. Screw-assembling the silos, positioning and mounting the railings and connecting walkways. If only a small number of silos are involved, it is advisable for the crane and vehicles to be provided by the customer, since he will be familiar with local conditions. We will, however, provide all the advice at our disposal. Experiences crane operating companies are usually able to provide suitable equipment when notified of the operation concerned. Alternatively, they can consult Zeppelin for advice. Given efficient organization, and provided the silos are erected on foundation base rings and need only be transported over reasonably short, convenient distances, two assemblers can erect up to six silos on one day and complete the assembly on the second day (32-40 working hours). If the customer can supply fitters form his staff (who must not suffer from vertigo) it should be sufficient if we supply a supervisor to direct the customer's personnel (one to two people). We calculate the costs of assembly as follows: - Travel and standard working time, at home or abroad Supervisor Skilled assembler Overtime supplements 25 %, 50 % or 100% of the above rates, in accordance with the tariffs agreed by the Suedwuerttemberg Hohenzollern Metal Industries. - Travel allowance in accordance with the applicable tariff agreement. In the case of outward or return travel by personnel at an intermediate time of day, the travel allowance is reduces in accordance with the recognized regulations.	

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Enquiry Form for ZEPPELIN High Quality Silos

ZEPPELIN®

Date: _____ Project: _____

Company´s Name: _____

P.O.Box/Street: _____

Postal code, Town: _____

Correspondent: _____

Department/Building: _____

eMail: _____

Telephone: _____ / _____ Telefax: _____

Please return to:
ZEPPELIN Silo- und Apparatetechnik GmbH
Leutholdstraße 108
D-88045 Friedrichshafen

Your ZEPPELIN specialist:

_____

Phone.: ++49-75 41 / 20 2 - ...
Telefax: ++49-75 41 / 20 2 - 4 91

Notes:

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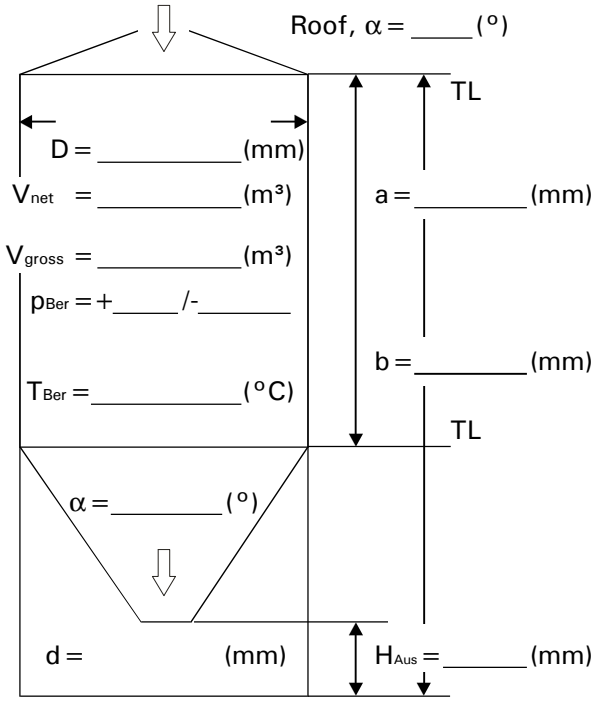
max. _____ (m³/h) / DN: _____



Requested time of delivery: _____

Type of silo: _____ Material: _____

No. of silos: ____ Distance between silo centers: ____ (mm)

☐ Pressure Proof Silo ☐ Emboxable Silo

☐ Blending Silo ☐ Multi-Chamber Silo

Site location: _____

☐ Construction on steel frame, Height above ground: _____ (mm)

☐ with foundation ring ☐ with weighing system ☐ with filter

Product discharge facility: _____

max. _____ (m³/h) / DN: _____

Bulk solids data:

Product designation: _____

_____

Medium grain size d_{50}: _____ (μm)

Bulk density: _____ (g/l)

☐ Discharge facility required ☐ Danger of dust explosion ☐ Loads assumed according to standard ?

Enclosures (if necessary):

☞ ☐ Sketch of silo ☐ Sketch of assembly ☐ Safety data sheet ☐ Product data sheet

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ZEPPELIN®

Terms and Conditions of Sale, Supply and Delivery of Zeppelin Silo- und Apparatetechnik GmbH - Leutholdstraße 108 - D-88045 Friedrichshafen

1. Extent and Scope of Supply
Extent and scope of supply shall be subject to mutual agreement in writing. In the absence of such agreement, the seller's acknowledgement of order shall apply. Verbal agreements shall have no effect unless confirmed in writing. Specifications, drawings, illustrations, particulars of weight and dimensions and other data submitted with the quotation are approximate only, unless specifically identified and confirmed as binding. The seller will retain property and copyright in all proposals and estimates, drawings, specifications and other documents and data, and the purchaser will not disclose them to any third party. Drawings, specifications and other documentation submitted with proposals or furnished for quotation purposes shall be returned to seller on request and/or if quotation or proposal does not result in a contract or purchase order.

2. Prices
Unless otherwise agreed, prices will be for delivery ex works, unpacked and unloaded; and in the event of orders for processing and treatment of materials, prices shall apply subject for free issue materials, suitable for the intended purposes, being delivered carriage paid into the sellers works in satisfactory conditions.

3. Packing and Loading
Unless otherwise agreed, packing and loading will be charged as an extra, at cost. Where cases and crates are returned complete and undamaged free to sellers premises, two thirds of the amount charged to the purchaser will be credited to his account. Advance deductions for returned packing will not be permitted. Open sided crates and lattice-boxes are exempt form this refund and will not be taken back.

4. Shipment and Dispatch
Unless otherwise agreed, goods will be dispatched and shipped for account and risk of the purchaser, and the seller does not accept any responsibility for arranging lowest-cost transport and carriage. No claims will be permitted for loss, damage to, or other deterioration of goods in transit.

5. Delivery Dates and Delivery Delays
The term of delivery shall commence on the date all order documents are available to the seller, all deposits and/or advance payments are made by the purchaser, and all technical details are agreed and confirmed. Delivery schedules, dates or periods are **approximate** only.

Late delivery shall not entitle the purchaser to claim indemnification for loss of interest, nor to claim penalties for default, non-performance, **etc.** The seller shall be entitled to an appropriate adjustment of delivery period where delays are caused by unforeseeable incidents in his works or in that of his supplier(s), or by incidents or occurrences beyond his reasonable control. Such incidents and occurrences include, but are not limited to, force majeure, war, acts of government, commandeering or confiscation, strike, riot, epidemics, works accidents, labor or materials shortages, transport delays, an essential part, component or assembly becoming or proving to be unserviceable or useless, quota systems being imposed, and in general all other actions, incidents or occurrences that cause a reduction in or discontinuance of production. In the event of any such incident or occurrence, the seller shall in addition have the right, at this option, to withdraw from the contract. In all these cases the purchaser shall **not** be entitled to claim damages for delayed delivery or for non-performance.
No penalties are agreed in the contract.
Items or goods ordered on call-off will be invoiced upon their completion, regardless of shipping or call-off date. Such items or goods will be stored on the seller's premises over and above the agreed period as an exception only, and invariably at the purchaser's risk.

6. Complaints and Liability
For defects, including absence of contractually agreed or stipulated features, characteristics and/or properties, the seller shall, to the exclusion of any further claims, be liable to the extent only, that he shall, at his option, repair or replace ex works and free of charge any of the goods or parts thereof that are found to be or have become defective within a period of 6 months from date of delivery, such defects without any doubt being attributable to any action or inaction on the part of the seller during the period before property and risk in the goods have passed to the purchaser, and such defects in particular rendering unfit, causing to be unserviceable, or greatly limiting the use of any such goods or part thereof due to faulty design, structural defects, improper materials, bad workmanship. This liability does not extent to normal wear and tear nor damage or defects due to improper or unworthmanlike handling or servicing, excessive use, unsuitable works facilities, etc. The liability period for structures, edifices, buildings, shall be 2 years. For repairs or replacements within the frame of this liability commitment, the seller will supply, free of charge, the required material(s), spares or replacement parts ex works, and he will, if deemed necessary by him, provide skilled labor for the installation of such material(s), spares or replacement parts, free of charge. For the rest, the conditions of clause 7 will apply also in the event of provision of labor and man-power by the seller. All further claims for defects or deficiencies in the supplied goods (conversion, reduction, and indemnificatin) shall be excluded to the extent as this is legally admitted. This shall apply in particular to any claims for loss of profit, for reimbursement of direct or indirect costs arising from acceptation, handling, trading or the use of defective goods or parts thereof by the purchaser, and to any other consequential damages. The seller shall not be held liable for shortcomings due to faulty design, incorrect performance, bad workmanship, or to other defects and deficiencies in documentation or parts made available to him by the purchaser or by thirds, provided however that the seller has not violated any obligation possibly incumbent on him to check, examine or verify. Such parts as are made obsolete by replacement shall become the property of the seller.

7. Installation and Erection of Equipment on Site
In the event that the seller provides any manpower for the installation and erection on site, the following shall apply: Preparations must be perfected to such an extent that all the seller's personnel will be able to commence operations directly upon arrival on site, and will be able to continue working without undue interruptions, discountenances, down-time, delays of any kind, and also repeated travels, when not caused by any fault, negligence, oversight of, or otherwise ascribable to the seller, shall be for the account of and will be charged to the purchaser. Unskilled labor and general help shall be provided by the purchaser, at his cost, and he will also be responsible for construction work as well as for erecting, or have erected by others, the necessary scaffolding and work platforms, and the purchaser shall further be responsible for provision of the required commodities and auxiliaries such as water, oxygen, etc. The purchaser shall, to the best of his knowledge, attest or certify as correct the erection crew's weekly work sheets. The purchaser shall also provide a certificate confirming termination of erection operations. Erection work will be charged for at daily rates which shall be agreed or contractually settled on placement of order: the same applies to possible overtime and work on Sundays and public holidays. Travelling hours and down-time are considered working hours and will be invoiced accordingly. Fares, and the transport of personal effects and luggage, equipment and tools, shall be borne by the purchaser. Accommodation and provisions will also be charged to the purchaser at rates that shall be agreed and settled in advance.

8. Termination and Cancellation
In the event that , after having formally acknowledged the purchase order, the seller receives information questioning the purchaser's solvency in regard to providing coverage for the order amount, and in particular, if facts in support of these doubts emerge, such facts being, for example, suspension of payments, legal injunctions, a receiver being appointed, liquidation of business, or if the purchaser mortgages, assigns or transfers title and ownership of goods, or outstanding debts, or if he does not pay invoices even after having been warned, then the seller shall have the right at his option, to request security or collateral or prepayment for existing orders, or to insist on payment in cash even if some other form of payment was agreed or if he already has accepted the purchaser's draft in settlement: or to cancel or terminate the purchase order or supply contract forthwith, without prejudice to any other rights hereunder, in particular the right to claim damages for non-fulfillment or non-performance.

9. Reservation of Title
The seller retains title and ownership in all goods until such a time as goods are paid for in full and all other claims the seller may have against the purchaser have been met and settled (extended title or lien in goods). During this time the purchaser shall not have the right to dispose of goods in any manner outside the normal course of business, including, but not limited to, mortgaging or transferring title as security or collateral. The purchaser shall be under obligation to notify the seller, without delay, of any attempt by third parties to obtain title to the goods, or of any other measures by third parties impairing or encroaching upon the seller's rights or ownership. In urgent cases, such notification shall be done by telephone, telex, telefax or telegram.
If the purchaser has disposed of the goods in the regular course of business, reservation of title to the goods shall be replaced by the claim the purchaser has against the third party. This claim the purchaser herewith cedes or assigns to the seller, and the seller herewith accepts such cession or assignment (extended title or lien in goods). The purchaser agrees to reserve title in goods until such goods have been paid for in full by any third party (passed-on lien in goods).
If the purchaser has treated, processed , combined, mingled or installed the goods in other goods the purchaser herewith cedes or assigns all his claims to title, joint ownership, surrender, payment, with respect to the newly made, processed, or fabricated items, parts, products, or goods, to the seller, and seller herewith accepts this cession or assignment. The seller agrees that upon request of the purchaser he will release any security or collateral as far as their value surpasses the purchaser's total claim by more than 20 per cent.

10. Terms of Payment
Unless otherwise agreed, payment for delivered goods will become due within 30 days from delivery, at the point of payment by the seller. For late payments, interest on arrears will be charged to the amount of four per cent (4 %) over and above the minimum lending rate of the Landeszentralbank. Withholding payments, non-return of drawings or other documents or items which are the seller's property and also the setting off, or balancing of any claims the purchaser may have against any title or claims of the seller will not be recognized, nor any deductions form the agreed purchase price. Drafts and checks will be accepted subject to funds being available on their presentation. Any extras or fees arising therefrom are for the account of the purchaser.

11. Place of Settlement and Court of Law
The settling-place, or point of payment, for all liabilities stemming from this purchase order will be, for both parties, the place of residence, or domicile, of the seller and the jurisdiction will be the seat of the court of law, responsible for the seller's domicile.

12. The above terms and conditions apply without further notice also to future orders. Any contradictory terms or conditions of the purchaser will be deemed null and void. Should one or several of the above terms and conditions be or become ineffective, this will not affect the effectiveness of all other terms and conditions.

13. Offers, proposals and quotations are, in principle, without engagement and subject to goods being unsold.

Stand 01.10.2001

Sales Conditions for Silos made from Aluminium and Stainless steel

Silo Capacities
The specified silo capacities are calculated from the combined volume of the cylinder and discharge hopper in accordance with the drawings in the catalogue, rounded up or down. Claims will not be accepted in respect of divergent volumes. If required, the discharge hopper attachment in the silo shell can be raised or lowered.

Static Configuration
Standard ZEPPELIN silos are configured in accordance with the load and bulk solids data given on page 2 of this catalogue. To prevent the base carcass or silo shell form becoming distorted, at least 80 % of the surface of the supporting rings must rest on the substructure (foundation, steel frame, roof of building, etc). Guidelines on the design, calculation and construction of steel frames should be obtained from ZEPPELIN (Notice G).

You have to inform us before placing the order about deviating earthquake-, wind- or snow loads or other additional loads. Eventual additional costs which result from changes in load will be charged to you.

Static Stress Analyses
If a static stress analysis is required, this will besuppliedupon receipt of the purchase order for the silo/s. Verification by an expert, if required, should be commissioned by the construction contractor at his expense.If, as an exception, a static stress analysis is required before the order is placed, we charge a nominal fee which is credited when the order is received (Pricecode ST01).

Materials
The conical roof, silo shell, discharge hopper and silo skirt are made of AlMg3, accessories of AlMg3 or AlMgSi. Bolts and other fastening components are made from stainless steel. Foundation base rings and anchor bolts made form steel are supplied unpainted. We absolutely recommend the use of galvanized foundation rings. If they are not galvanized you will have to paint them. We would like to paint out that ZEPPELIN does not accept responsibility in caseofnon-galvanized foundation rings.

Surfaces
The surfaces stay untreated. We will not accept any liability for damage to surfaces in transit or during assembly. Silos are washed internally after completion. Depending on requirements, we recommend to clean silos and pipelines before use. Possible discolouration of single shells of Aluminium silos are due to production on the part of the Aluminium producer. It doesnotimpair the function and is no defect.

Weld seams (only Aluminium silos)
SeamsareweldedairtightbytheMIGandTIGprocesses.Forreasons of process technology and strength, weld seams remain untreated. Possible weld spatter or other irregulatities are removed. The treatment of the weld seams with stainless steel silos is made as perspecifications.

Manufacturing Tolerances
Manufacturing tolerances are assessed in accordance with Procedure Instruction 20 VA 04 007.

Packaging
Packaging for transport on land will be invoiced according to expenses.

Storage
Silos for which firm delivery dates have been stipulated or which should be delivered on call are usually stored on our premises if the consignee will have no possibility to keep the silo on site up to their installation. Intermediate storage will be free of charge for the first 3 weeks - calculated from the delivery or call date agreed upon. From the 4th week we would have to charge you with a storage fee of DM 85,00 per week and silo.

Transportation
In case that the maximum admissible dimensions for transportation of silos by road or truck are exceeded, we will prepare sketches for loading of the material. Furthermore, we will apply for the required special transport permissions.

We cannot accept any liability for unpunctual availability of the rail wagons, for an extended duration of the transport, rest times of the cranes on site and similar consequences resulting from delayed transportation.

In case that the goods will not be collected by you directly after readiness for shipment, the goods shall automatically become our property - subject to receipt of payment - and a contract for keeping the goods will be automatically concluded so that the goods are kept on our premises at your risk. Following readiness for shipment ZEPPELIN will only be liable for damages caused intentionally or by an act of culpable negligence.

Dates of Delivery
Delivery dates will have to be agreed upon. We keep an ample material storage contingency thus being in a position to take on short-term dates in individual cases - subject to free shop capacities.The agreed delivery date will be guaranteed under the condition that the customer supplies technical clarification and drawings approval as scheduled. If we receive technical clarification after permission was supplied this may result in changesofdelivery date andpriceterms.

Delivery
For delivery of the silos free access to site shall be guaranteed for the transport means if the assembly will be carried out by ZEPPELIN, the following pre-conditions shall be fulfilled:

- Availability of sufficient space to position the large crane vehicle
- One small and one large crane vehicle shall be supplied by the customer, depending on the size of the silo
- One traverse shall be supplied by customer
- At least two helpers and the tools required shall be supplied free of charge for ZEPPELIN

In winter the silos might get dirty during transportation due to weather conditions. In order to avoid any possible visual effects caused by salt of grits we recommend to clean the silos and accessories immediately upon their arrival with a steam cleaner. On order, cleaning could be effected by the truck driver against a fee of DM 210,00 per silo, the steam cleaner should be available on site free of charge for us. We cannot accept any liability for visual disturbances which are due to weather conditions.

Price Terms
Prices are based on the price list which is valid on the date of quotation. Our prices are net, ex works, loaded, exclusive of packing costs, duty unpaid, local V.A.T. unpaid.

Reservation for PriceModification
The prices are calculated on the basis of the material prices and wages which are applicable at start of printing. For the case that the material prices and wages will change or the design will be modified, we reserve the right to change our prices. If the manufacturing drawings for the silo will be subject to modification while the order is carriedout, we reservetheright,to adaptthepricesaccordingly.

Payment
1/3 on receipt of order confirmation
1/3 on delivery/shipment readiness
1/3 30 days after delivery/shipment readiness

Guarantee
We guarantee the use of fault-free materials, efficient manufacturing processes and the dimensional conformity and durability of our silos and accessories for a period of 12 months after entry into service or a maximum of 18 months after delivery or notification of readiness for shipment. The purchaser is responsible for the selection and arrangement of accessories. Please note, that some types of PET pellets lead to development of noise (sounding like a horn) during discharge from silos. This cannot be considered as a fault and we, therefore, cannot any liability for subsequent costs.

Silos in Operation
Please note that we cannot accept any responsibility for any damages to the silos due to asymmetric flow of bulk solids or arching. We cannot accept any liability for any defects at silos which could result from the asymmetric flow of bulk solids or for arching. Furthermore, please note the bulk solids´caracteristics which are indicated in our order confirmation. The operatoroftheplanshallberesponsiblefortheobservation.

Testing
The silos are tested according to ZEPPELIN standard with regard to dimensional and geometrical accuracy.

Documentation
We will provide you with the following documents:

- Silo drawings
- Static calculation ready for approval
- Foundation load data
- Documentation for accessories if applicable

Alterations
We reserve the right to introduce technical changes in the interest of product improvement.

Furthermore, please note the enclosed General Terms and Conditions of Sale, Supply and Delivery.

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