CELO

REMFORM® II HS™

For highly demanding plastic assemblies

REMFORM® II HS™

REMFORM® II HS™ (High Strength) screws have been developed for the direct assembly of thermoplastics in applications with high mechanical requirements.

The improved thread design results in a more resistant, safe and optimized assembly of fiber reinforced thermoplastics, offering high clamping force, pull-out and vibration loosening resistance.

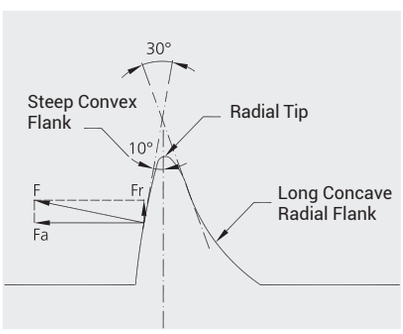


Fig.1. During thread forming, the Steep Convex Flank transfers most of the tightening load in the axial direction (Fa), minimizing radial force (Fr) and consequently plastic deformation. The axial force (Fa) is over 4,5 times greater than radial force (Fr).

1. Technical features

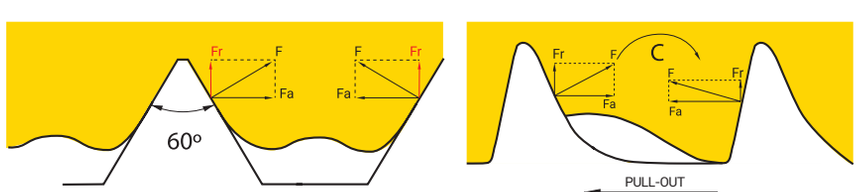
- **Asymmetric thread design of 30º**

Unique Radius Flank™ asymmetrical thread design remains the main characteristic of REMFORM® II HS™ thread. Its optimized design **reduces hoop stress** generated in the plastic during thread forming and consequently the risk of boss bursting. It consists of:

Steep Convex Flank also known as Trailing Pressure Flank. It has a subtle radius designed to **increase resistance to pull-out forces**, whether they are applied by a tensile load or induced by torque. It provides excellent material contact which results in a high resistance to stripping.

Long Concave Radial Flank also known as Leading Thread Flank. Its special radius form produces forces of variable directions which promotes efficient material flow increasing resistance to pull-out forces. Major surface contact with nut member material **increases vibration loosening resistance.**

Radial Tip helps to create better internal thread and reduces hoop stress in the plastic.



Self-tapping screw REMFORM® II HS™

Fig.2. Resolution of resultant forces on pressure and leading flank.

- **Optimized core diameter**
  The increase in core diameter results in **higher torsional and tensile strength,** usually required when assembly in fiber reinforced or high strength materials.

- **Optimized thread pitch**
  The reduction of the thread pitch allows more threads to be in contact with the plastic mating material increasing vibration loosening resistance and the possibility to reduce the length of thread engagement.

  The optimized core diameter and pitch distance result in better material flow toward the trailing flank, resulting in more material between the flanks. It reduces the risk of overstressing the plastic and provides higher pull-out resistance.

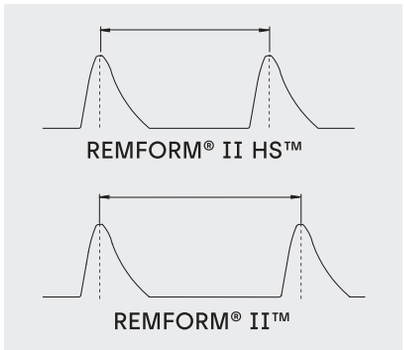


Fig.3. For the same thread diameter, the smaller pitch of REMFORM® II HS™ thread increases pull-out resistance.

2. Advantages

- The low radial forces minimize the risk of overstressing and cracking of the plastic. It allows for **bosses with smaller external diameter**, which offers great **opportunities for cost reduction**.

- **High resistance to pull-out forces, vibration loosening and stripping.**

- **Higher torsional and tensile strength** allows for a higher tightening torque and clamping force.

- **Low thread forming torque and high stripping torque** offer optimal safety during assembly.

- Thread design **permits to reuse the screw** reducing the risk of stripping.

- The technical advantages of REMFORM® II HS™ screw directly results in a **more resistant assembly, greater safety** during threading and **lower costs** of the assembly process.

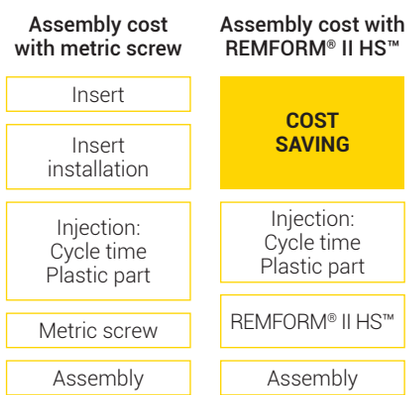
3. Reduction of the cost of the assembly

The use of REMFORM® II HS™ screws offer substantial savings when comparing with conventional screws for plastics, self-tapping screws and threaded inserts.

- **Elimination of threaded inserts and its associated costs.**
  REMFORM® II HS™ screws create a strong nut member into reinforced plastics, replacing inserts and offering significant improvements in injection molding process and recycling of the parts.

- **Reduction in plastic weight components.**
  Minimal radial tension during thread forming allows for thinner walls and reduced length of engagement enables shallow insertions depth. The plastic part can be manufactured with less material and reduced cycles times in molding process.

- **Reduction of screw diameter and/or length.**
  REMFORM® II HS™ screws achieve the same thread engagement than conventional screws for plastics but considering smaller diameter or shallow insertion depth.

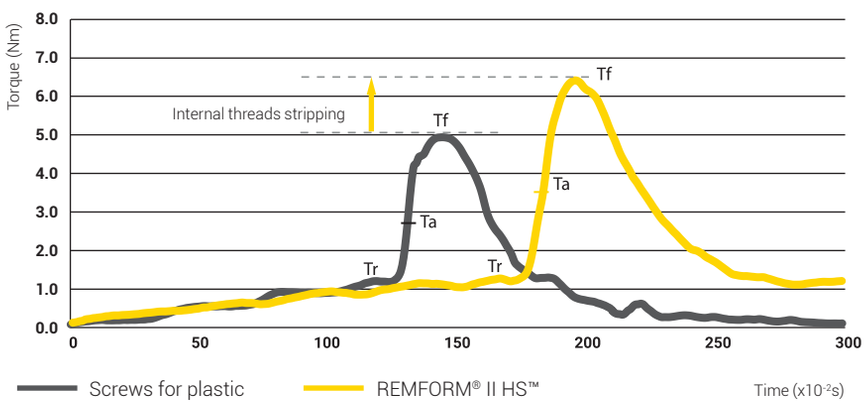


REMFORM® II HS™ Minimum Breaking Torque	
d (mm)	Torque(Nm)
1.8	0.29
2.0	0.41
2.2	0.57
2.5	0.85
3.0	1.55
3.5	2.52
4.0	3.83
4.5	5.53
5.0	7.50
6.0	13.30
7.0	19.44
8.0	32.10

4. Threading curve

In fiber-reinforced plastics, the smaller pitch of REMFORM® II HS™ screw greatly improves failure torque without a significant increase of threading torque. The higher amount of threading energy provides the assembly with a higher prevailing torque which improves vibration loosening resistance of the assembly.

The graph below shows a comparison of threading curves for REMFORM® II HS™ and standard screw for plastic, both diameter Ø6,0 mm in a PP + 20% glass fiber part, core hole Ø5,0 and 12 mm engagement length.



When comparing with a conventional screw for plastic, REMFORM® II HS™ screw offers greater safety during assembly (difference between threading torque and failure torque). The higher stripping torque guarantees a more reliable assembly process and an increased stability during installation.

Threading torque (Tr) is the minimum torque necessary to ensure that some clamping force is loaded to the assembly. This value is represented by the maximum torque within this zone.

Failure torque (Tf) is the torque value when the assembly fails at any point. It is the maximum torque allowed in the system and corresponds to the maximum value (peak) of the curve. The failure mode determines the way the assembly fails. For the graph detailed before, the failure mode is stripping off (shearing of the internal threads).

Optimum tightening torque (Ta) ensures the right clamping force and avoids undesired deformation in plastic parts.

The tightening torque depends on the screw breaking torque, friction coefficient, hole dimensions, length of engagement and screwdriver stability. The optimum tightening torque is determined based on threading curve tests in the laboratory.

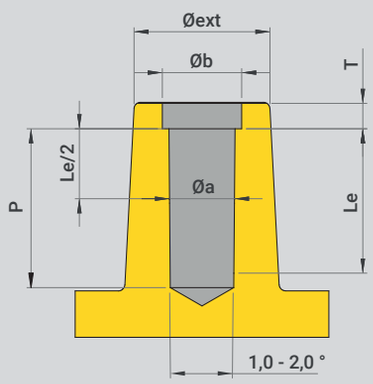
5. Boss design recommendations

In order to ensure a safe installation and stable clamping force, it is relevant to pay attention to the boss design, as it must resist mold extraction and cooling tension as well as tension created during screw installation.

It's important to include a relief bore to prevent damaging the boss when starting thread forming. The relief bore also helps to align the screw during threading.

The dimensions for external diameter, core hole diameter and minimum depth will vary based on the type of plastic.

For additional information about the boss design for direct assembly in plastic parts, please contact our technical department.



d = screw diameter
Length of engagement Le = 2.3 x d
Minimum depth P = 2.9 x d
T = 0.25 - 0.5 x d
Øa = 0.75
Øb = 1.05 - 1.1 x d
***For PC:**
Le = 2 x d

Material	Øa	Øext
PC*	0.80 x d	2.1 - 2.6 x d
PE + 30GF	0.80 x d	2.1 - 2.6 x d
PA6 + 15GF	0.80 x d	2.1 - 2.6 x d
PC + 10GF	0.81 x d	2.1 - 2.6 x d
PMMA	0.81 x d	2.1 - 2.6 x d
PA66 + 15GF	0.81 x d	2.1 - 2.6 x d
ABS + 20GF	0.81 x d	2.0 - 2.5 x d
PPO + 30GF	0.82 x d	2.0 - 2.5 x d
ABS + 30GF	0.82 x d	2.0 - 2.5 x d
PC + 30GF	0.82 x d	2.0 - 2.5 x d

Material	Øa	Øext
PP + 30GF	0.82 x d	2.0 - 2.5 x d
POM + 30GF	0.82 x d	2.0 - 2.5 x d
PA6 + 30GF	0.82 x d	2.0 - 2.5 x d
PA66 + 30GF	0.82 x d	2.0 - 2.5 x d
PPA + 30GF	0.82 x d	2.0 - 2.5 x d
PET + 30GF	0.82 x d	2.0 - 2.5 x d
PBT + 30GF	0.82 x d	2.0 - 2.5 x d
PS + 30GF	0.83 x d	2.0 - 2.5 x d
PPS + 40GF	0.83 x d	2.0 - 2.5 x d
PA6/PA66 +45GF	0.84 x d	2.0 - 2.5 x d

Suggested tolerances are:
+0.08 mm for holes ≤ Ø3.0 mm
+0.10 mm for holes Ø3.0 - Ø4.5 mm
+0.12 mm for holes > Ø4.5 mm

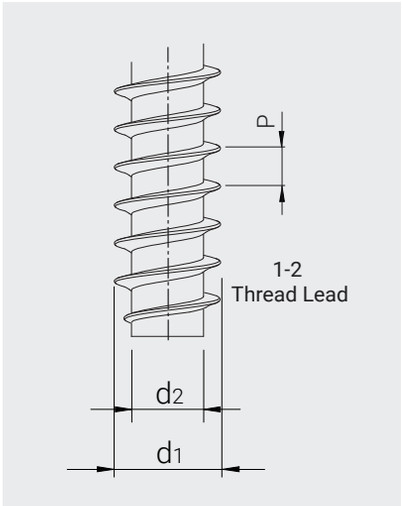
For softer plastics not listed above, use Øa = 0.75 x d and other parameters as detailed for PC.

This data is intended for guidance purposes. We recommend carrying out relevant tests on plastic parts to establish the precise values.

Contact us on celo@celo.com for further details.

Need to get in touch? Contact us to discuss your application.

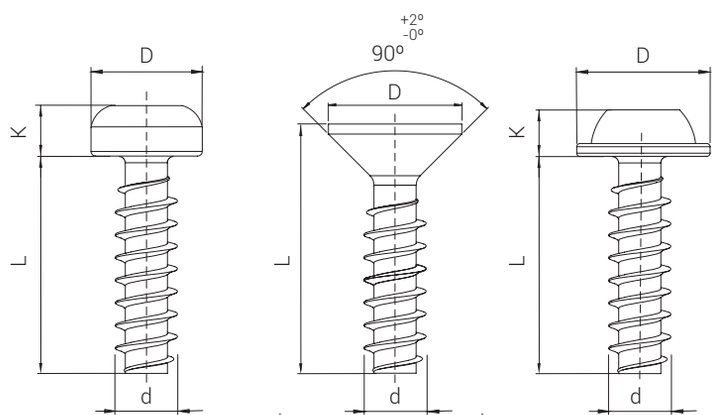
Contact us

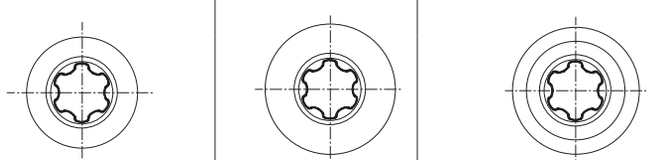


6. Technical data

REMFORM® II HS™ screws can be manufactured with different head types, recess, dimensions and coating configuration to fit your exact application requirements. To ensure the quality of the screw we apply baking process to reduce the risk of hydrogen embrittlement (more information in page 124).

The table shows thread and head dimensions under CELO manufacturing standards. For different head design, recess or threaded length, please contact our technical department.





Ref. HS81PA | Ref. HS82PA | Ref. HS87PA

Nominal Value (mm)	Tolerance h14	Tolerance h15
To 3	0 -0.25	0 -0.40
Over 3 to 6	0 -0.30	0 -0.48
Over 6 to 10	0 -0.36	0 -0.58
Over 10 to 18	0 -0.43	0 -0.70

d	d1	d2 min.	P	Breaking torque min.(Nm)	D h14	K h14	TORX Plus® AUTOSERT®	D h14	TORX Plus® AUTOSERT®	D h15	K h14	TORX Plus® AUTOSERT®
1.8	1.8 +0.08	1.17	0.71	0.29	3.20	1.50	5 IP			4.20	1.40	5 IP
2.0	2.0 +0.08	1.28	0.78	0.41	3.40	1.60	6 IP	4.00	6 IP	4.30	1.50	6 IP
2.5	2.5 +0.10	1.64	0.95	0.85	4.30	2.10	8 IP	5.00	8 IP	5.30	2.10	8 IP
3.0	3.0 +0.10	2.01	1.12	1.55	5.30	2.30	10 IP	6.00	10 IP	6.30	2.20	10 IP
3.5	3.5 +0.10	2.37	1.29	2.52	6.20	2.60	15 IP	7.00	15 IP	7.30	2.60	15 IP
4.0	4.0 +0.10	2.73	1.46	3.83	7.00	3.10	20 IP	8.00	20 IP	8.30	2.90	20 IP
4.5	4.5 +0.10	3.09	1.63	5.53	7.50	3.40	20 IP			10.00	3.0	20 IP
5.0	5.0 +0.15	3.43	1.80	7.50	9.00	3.60	25 IP	10.00	25 IP	10.50	3.60	25 IP
6.0	6.0 +0.15	4.16	2.14	13.30	10.80	4.20	30 IP	12.00	30 IP	12.50	4.00	30 IP
7.0	7.0 +0.18	4.86	2.48	19.44	12.50	4.80	40 IP			15.00	4.80	40 IP
8.0	8.0 +0.18	5.58	2.82	32.10	14.00	4.80	40 IP			17.00	5.00	40 IP

Dimensions in mm. Unless expressly stated, the values shown are nominal. For tolerances and other data, please contact our technical department.

7. Products in Stock

HS81PA	HS87PA	HS82PA	HSX81PA
			
• Pan head • TORX Plus® AUTOSERT® recess • Zinc plated Cr (III) 8µm + Sealant + Baking Go to product >	• Pan head flange • TORX Plus® AUTOSERT® recess • Zinc plated Cr (III) 8µm + Sealant + Baking Go to product >	• Countersunk head • TORX Plus® AUTOSERT® recess • Zinc plated Cr (III) 8µm + Sealant + Baking Go to product >	• Pan head • TORX Plus® AUTOSERT® recess • Stainless steel A2 Go to product >

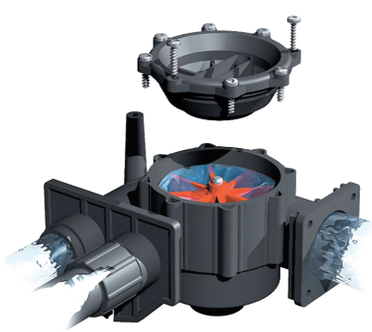
Electroplated Zinc plated Cr (III) 8 µm + Sealant provides better corrosion resistance and guarantees **144 hours in Neutral Salt Spray (NSS) test without red rust.**

8. Applications

REMFORM® II HS™ screws are the optimal solution for the assembly of high strength or fiber reinforced materials that require:

- High clamping force.
- High pull-out resistance.
- High resistance to vibration loosening.

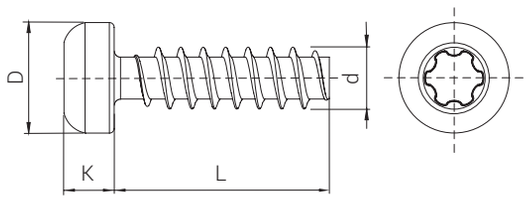
Automotive, electric material, electronics and household appliances.



HS81PA

REMFORM® II HS™

- **Pan head**
- **TORX Plus® AUTOSERT® recess**
- **Zinc plated Cr (III) 8µm + Sealant + Baking (144 h NSS)**



CAD Files and Samples available

Go to product

d mm	1.8	2.0	2.5	3.0	3.5	4.0	5.0	6.0
D mm	3.2	3.40	4.30	5.30	6.20	7.00	9.00	10.80
K mm	1.5	1.60	2.10	2.30	2.60	3.10	3.60	4.20
TORX Plus® AUTOSERT®	5 IP	6 IP	8 IP	10 IP	15 IP	20 IP	25 IP	30 IP

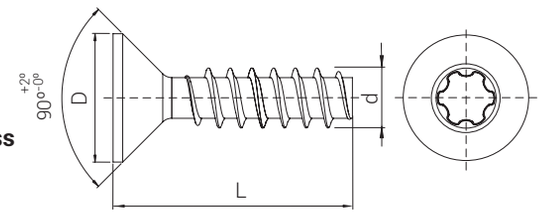
L mm	**Ø1.8**	**Ø2.0**	**Ø2.5**	**Ø3.0**	**Ø3.5**	**Ø4.0**	**Ø5.0**	**Ø6.0**
4	○	○	–	–	–	–	–	–
5	○	○	–	–	–	–	–	–
6	●	○	○	●	–	–	–	–
8	○	●	●	●	●	●	–	–
10	○	○	○	●	●	●	–	–
12	–	○	○	●	●	●	●	○
13	–	–	○	○	○	○	○	○
14	–	–	○	○	○	○	○	○
15	–	–	○	○	○	○	○	○
16	–	–	○	●	●	●	○	○
18	–	–	○	○	○	○	○	○
20	–	–	–	●	○	●	●	○
22	–	–	–	○	○	○	○	○
25	–	–	–	○	○	○	○	○
30	–	–	–	–	○	○	○	○
35	–	–	–	–	○	○	○	○
40	–	–	–	–	○	○	○	○
45	–	–	–	–	○	○	○	○

● Product available in stock. ○ Product available upon request.
For other plating, thread dimensions and head design, please contact our sales department.
Information about packaging conditions in page 130.

HS82PA

REMFORM® II HS™

- **Countersunk head**
- **TORX Plus® AUTOSERT® recess**
- **Zinc plated Cr (III) 8µm + Sealant + Baking (144 h NSS)**



CAD Files and Samples available

Go to product

d mm	2.0	2.5	3.0	3.5	4.0	5.0	6.0
D mm	4.00	5.00	6.00	7.00	8.00	10.00	12.00
TORX Plus® AUTOSERT®	6 IP	8 IP	10 IP	15 IP	20 IP	25 IP	30 IP

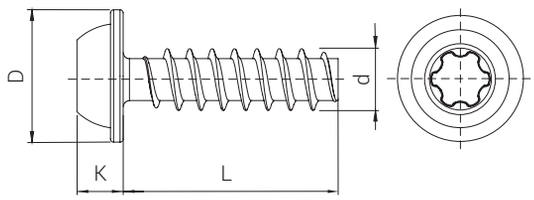
L mm	**Ø2.0**	**Ø2.5**	**Ø3.0**	**Ø3.5**	**Ø4.0**	**Ø5.0**	**Ø6.0**
6	○	○	●	–	–	–	–
8	●	○	●	○	○	–	–
10	○	○	○	●	○	–	–
12	○	○	●	●	●	–	–
13	○	○	○	○	○	○	–
14	○	○	○	○	○	○	–
15	○	○	○	○	○	○	○
16	–	○	●	○	●	○	○
18	–	○	○	○	○	○	○
20	–	○	○	○	○	○	○
22	–	–	○	○	○	○	○
25	–	–	○	○	○	○	○
30	–	–	○	○	○	○	○
35	–	–	–	○	○	○	○
40	–	–	–	○	○	○	○

● Product available in stock. ○ Product available upon request.
For other plating, thread dimensions and head design, please contact our sales department.
Information about packaging conditions in page 130.

HS87PA

REMFORM® II HS™

- **Pan head flange**
- **TORX Plus® AUTOSERT® recess**
- **Zinc plated Cr (III) 8µm + Sealant + Baking (144 h NSS)**



CAD Files and Samples available

Go to product

d mm	2.0	2.5	3.0	3.5	4.0	5.0	6.0
D mm	4.30	5.30	6.30	7.30	8.30	10.50	12.50
K mm	1.50	2.10	2.20	2.60	2.90	3.60	4.00
TORX Plus® AUTOSERT®	6 IP	8 IP	10 IP	15 IP	20 IP	25 IP	30 IP

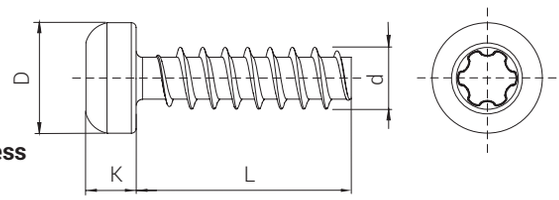
L mm	**Ø2.0**	**Ø2.5**	**Ø3.0**	**Ø3.5**	**Ø4.0**	**Ø5.0**	**Ø6.0**
6	○	○	○	–	–	–	–
8	●	●	●	○	○	–	–
10	○	○	●	○	○	○	–
12	○	○	●	●	●	○	○
13	○	○	○	○	○	○	○
14	○	○	○	○	○	○	○
15	○	○	○	○	○	○	○
16	–	○	○	○	●	○	○
18	–	○	○	○	○	○	○
20	–	○	○	○	●	●	●
22	–	○	○	○	○	○	○
25	–	○	○	○	○	○	○
30	–	–	–	○	○	○	●
35	–	–	–	○	○	○	○
38	–	–	–	○	○	○	○
40	–	–	–	○	○	○	○

● Product available in stock. ○ Product available upon request.
For other plating, thread dimensions and head design. please contact our sales department.
Information about packaging conditions in page 130.

HSX81PA

REMFORM® II HS™

- **Pan head**
- **TORX Plus® AUTOSERT® recess**
- **Stainless steel A2**



CAD Files and Samples available

Go to product

d mm	3.0	3.5	4.0	5.0	6.0
D mm	5.60	6.20	7.00	8.20	10.00
K mm	2.20	2.40	2.60	3.05	3.55
TORX Plus® AUTOSERT®	10 IP	10 IP	15 IP	20 IP	25 IP

L mm	**Ø3.0**	**Ø3.5**	**Ø4.0**	**Ø5.0**	**Ø6.0**
6	○	–	–	–	–
8	●	●	○	–	–
10	○	○	●	○	–
12	●	○	○	○	○
13	○	○	○	○	○
14	○	○	○	○	○
15	○	○	○	○	○
16	○	○	●	○	○
18	○	○	○	○	○
20	○	○	○	●	○
22	–	○	○	○	○
25	–	○	○	○	○
30	–	○	○	○	○
35	–	–	○	○	○
40	–	–	○	○	○

● Product available in stock. ○ Product available upon request.
For other plating, thread dimensions and head design, please contact our sales department.
Information about packaging conditions in page 130.

CELO

Small Things Matter

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● Production plant ● Logistic hub ● Sales office