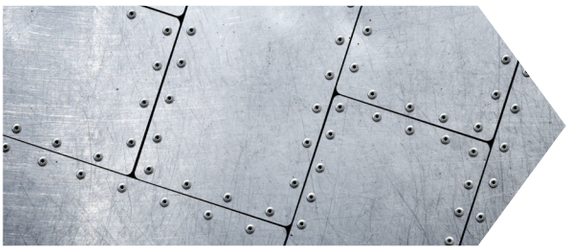
Development, production and servicing of cogeneration units



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indop

What is a CPH unit?

A CPH unit (combined heat and power, also cogeneration) is an independent power and heat generation unit.

It allows the user to either sell the entire amount of generated electricity into the electricity grid or use it for own consumption, and the thermal energy can be used for heating, hot domestic water preparation and various technological processes. In power generation, we can achieve primary energy savings of over 25 % compared to the separate generation.

Independent power and heat generation unit.

Target users

Due to wide applicability of CHP units, a great technological progress can be observed in their production, which is mainly reflected in their greater energy efficiency. The greatest advantage of a cogeneration system is the reliability of power supply, as it operates independently from the public power supply. Additionally, it is an excellent investment for buildings where heating of larger rooms is required. A wide range of CHP units of different nominal powers (rated power from 37 kW to 500 kW) provides supply for the widest group of users:

- large and small production plants
- health institutions,
- public education institutions,
- shopping and sports centres,
- natural parks and alpine huts,
- remote farms,
- business premises and
- regular residential buildings (houses, blocks of flats).

→ Reliable energy supply

25 %

savings in primary energy

Advantages of a CHP unit

→ The most energy efficient way of fuel utilisation.

Main advantages for the community and environment

- substantial savings in primary energy,
- production of environmentally friendly energy,
- lower emissions of greenhouse gases (CO^2) and emissions of other gaseous pollutants (CO, SO^2 and NOX),
- excellent biodegradability of the fuel,
- ecological fuel sources (natural gas, liquefied petroleum gas, fuel or vegetable oil, biodiesel, biomass)

Main advantages for the consumer

- lower electricity and heating costs,
- lower operating costs,
- higher energy yields,
- higher power supply reliability,
- power consumption independent of the public power supply

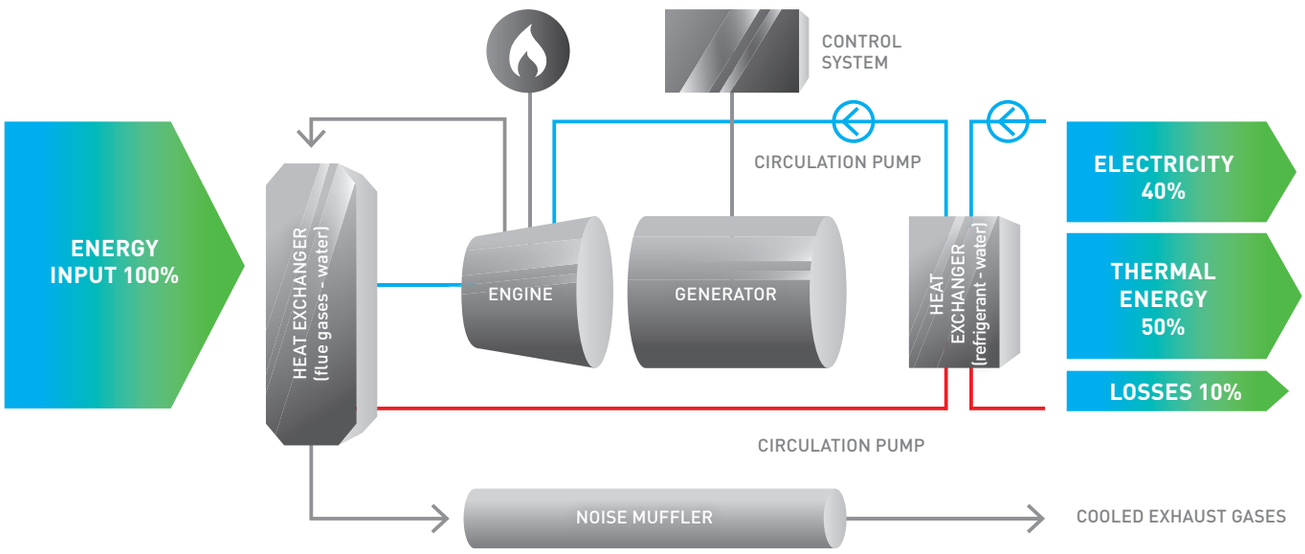
Operation

→ Effective transformation of 90 % of the energy input.

The main element of a CHP unit is a fuel fired four-stroke engine which converts the combustion energy of the fuel to thermal and mechanical energy; the latter is then converted to electricity by a generator. We therefore speak of Combined Heat and Power units. The exhaust gases are not discharged directly into the environment; they flow through a flue gas/heat exchanger where heat is extracted from them. The heat exchanger is connected to the external (secondary) circuit of the transmission line.

The control unit takes full control over operation of the entire CHP unit system. The control system is of key importance for proper operation as well as for diagnostics and elimination of potential defects.

A CHP system effectively transforms 90 % of the energy input, i.e. approximately 40 % as electricity and 50 % as thermal energy. Energy losses of a CHP unit amount to approximately 10 %.

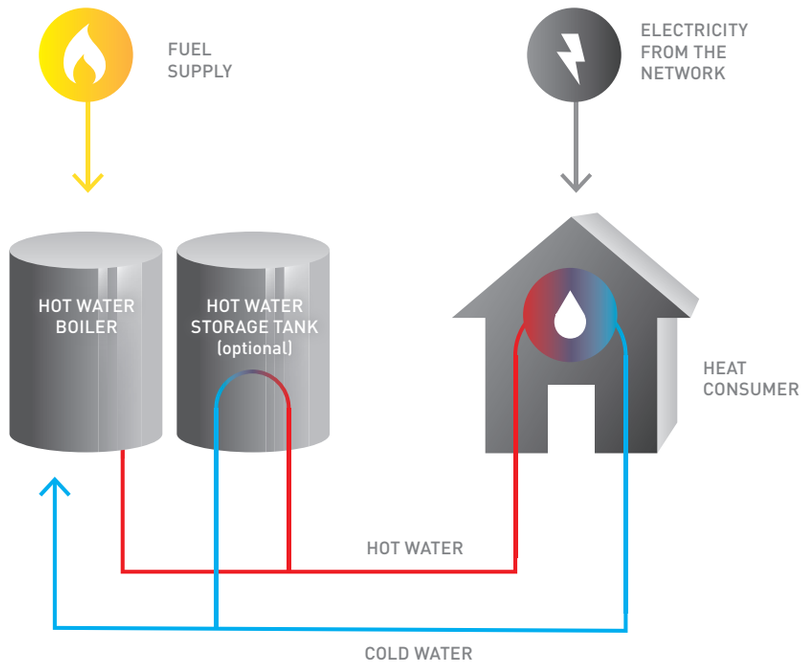


COMPONENT PARTS:

- ENGINE
  An engine designed to use different fuels: natural gas, liquefied petroleum gas, fuel or vegetable oil.
- GENERATOR
  A three-phase generator for power generation.
- HEAT EXCHANGER
  A heat intake system (heat exchanger: refrigerant to water, flue gas to water).
- CONTROL SYSTEM
  The unit control system.

Situation before installing a CHP unit

A classical energy system contains a water heating boiler intended for generation of thermal energy for heating and preparation of domestic water. Another option is the use of a hot water storage tank which serves for heat accumulation during shorter periods of power outage or reduced consumption. Electricity demand is covered by supply from the electricity grid.

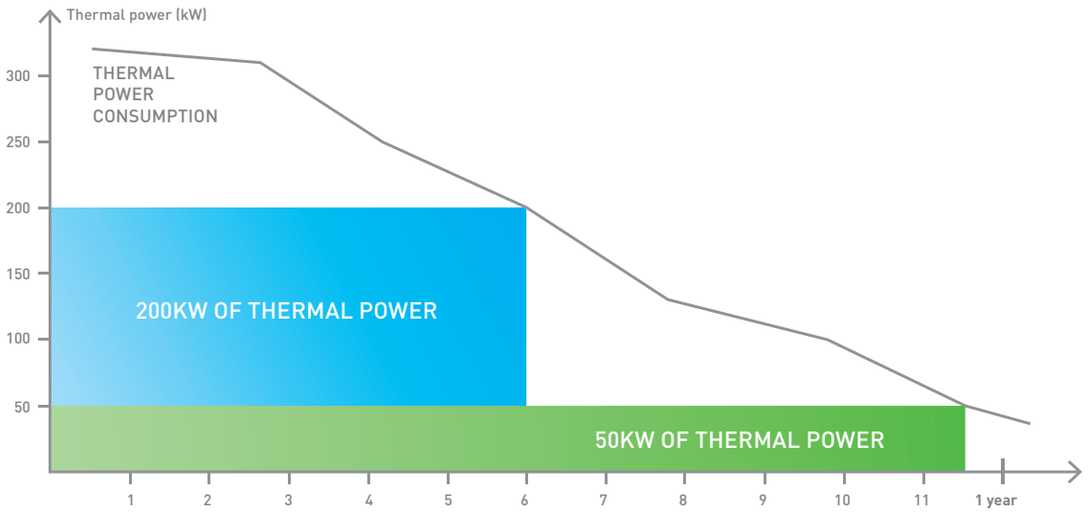


Situation after installing a CHP unit

→ It can be defined as a highly efficient system

Rated power of the CHP unit is sized according to the demand of the heat consumer. A combined heat and power system can be defined as a highly efficient system only when the generated energy, including thermal, is fully utilised. Considering the heat demand characteristics (Q-h diagram), a CHP unit of lower thermal power (50 kW) can be installed in the existing system to cover heat demand throughout the year (up to 7500 hours/year), or a unit of higher thermal power to cover heat demand mainly during the heating season (up to 4000 hours/year).

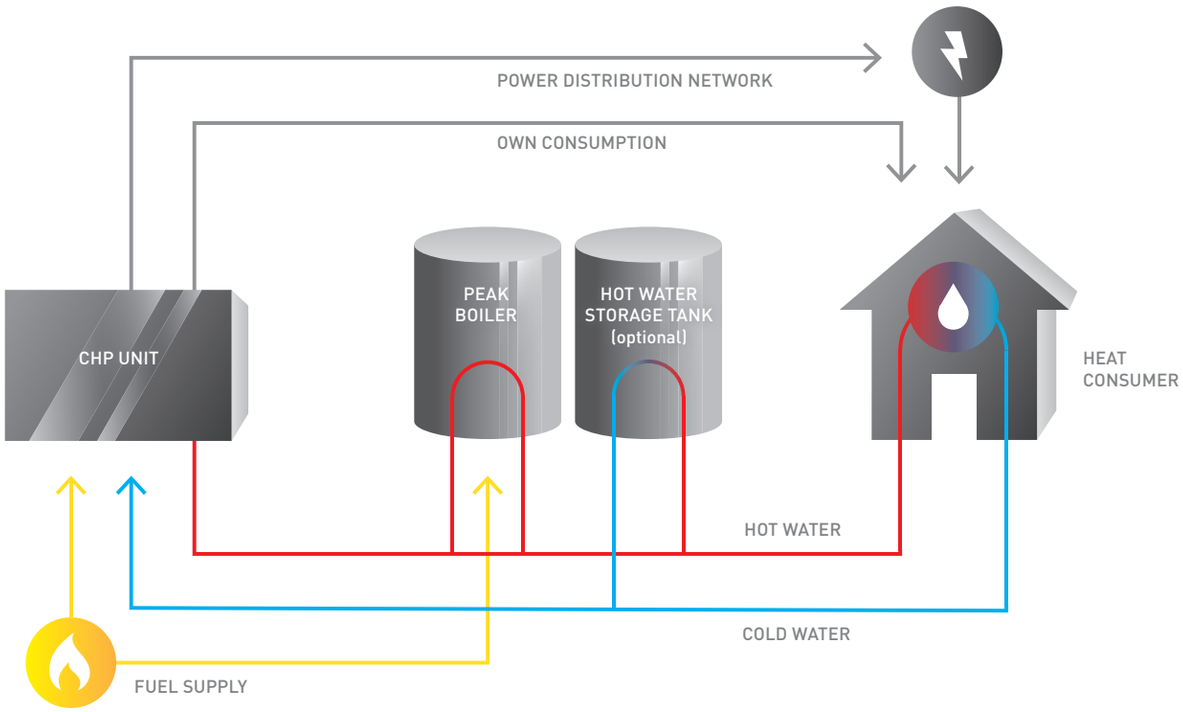
For greater flexibility in heat and power generation, two or more CHP units of equal or different rated power can be installed in the energy system.



→ It ensures 90% efficiency and conversion of the energy input

To cover peak heating powers, the system must also include a classical hot water boiler for heat generation, i.e. a so-called peak boiler. The boiler may also be used for heat generation in case of a repair intervention on the unit or when the CHP unit is not in operation due to a too low heat consumption rate.

A peak boiler can be sized either only to the difference between the maximum power of the boiler room and the rated power of the CHP unit or to the full maximum power of the boiler room. The system can also operate without a peak boiler, but in such case, heat consumption must be constant and oscillation-free.



Options for electricity consumption

→ The operation of CHP units is promoted by government grants

In most cases, the generated electricity is given away to the electricity grid. In case of greater demand, it can also be used for own consumption. In the first case, the state's subsidy for the sale of electricity is obtained through guaranteed purchase, and in the second case, through operating support.

Electricity for own consumption or feeding into the power supply network

Options for heat consumption

The generated heat, mainly in the form of hot water with the temperature of up to 90 °C, is distributed to consumers through a distribution system. The heat can be used for heating of rooms, hot domestic water preparation and various technological processes.

Heating of rooms, hot domestic water and technological processes

Natural gas, LPG and biogas fuelled CHP units

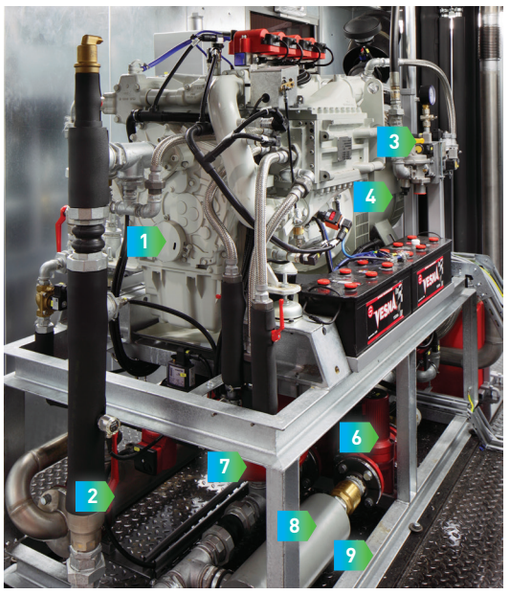
	INDOP 37M	INDOP 50M	INDOP 50T	INDOP 68M	INDOP 85T	INDOP 90T	INDOP 110M	INDOP 110T	INDOP 130T	INDOP 130M
ENERGY DATA										
mechanical power (kW)	37	54	54	68	86	89	110	110	132	130
→ **electrical power (kW)**	**35**	**49.9**	**50**	**64**	**82**	**84**	**104**	**105**	**125**	**122**
→ **thermal power (kW)**	**55**	**80**	**133**	**94**	**121**	**154**	**143**	**151**	**179**	**181**
Energy input (kW)	112	144	206	177	232	269	282	283	346	343
ENGINE TYPE	**MAN E 0834 E 312**	**MAN E 0834 E 302**	**TEDOM TP 90 G5V NX 86**	**MAN E 0834 LE302**	**TEDOM TG 85 G5V NX 86**	**TEDOM TP 90 G5V NX 86**	**MAN E 0836 LE202**	**TEDOM TG 110 G5V TX 86**	**TEDOM TG 130 G5V TX 86**	**MAN E 2876 TE302**
number of cylinders	4	4	6	4	6	6	6	6	6	6
volume	4580 cm^3	4580 cm^3	11946 cm^3	4580 cm^3	11946 cm^3	11946 cm^3	6870 cm^3	11946 cm^3	11946 cm^3	12820 m^3
EFFICIENCY (cos φ=1)										
electrical (%)	33.0	34.7	26.2	38.5	37.1	33.1	39.0	38.9	38.3	38.0
thermal (%)	49.1	55.6	64.2	53.2	52.2	57.1	48.9	53.3	51.6	52.8
→ **total (%)**	**82.1**	**90.3**	**90.6**	**91.7**	**89.3**	**90.2**	**87.9**	**92.2**	**89.9**	**90.8**
DIMENSION										
weight (kg)	1700	2000	2200	2200	2200	2200	3000	3000	3000	3000
LxWxH (m) internal unit	2.1x1.2x1.6	2.3x1.2x1.6	2.8x1.2x2.2	n2.8x1.2x2.2	2.8x1.2x2.2	2.8x1.2x2.2	3.3x1.2x2.2	3.3x1.2x2.2	3.3x1.2x2.2	3.3x1.2x2.2
fuel	NG	NG	LPG	NG/ BIOGAS*	NG/ BIOGAS*	LPG	NG/ BIOGAS*	NG/ BIOGAS*	NG/ BIOGAS*	BIOGAS

Consumption of natural gas with Hu_34 MJ/Nm^3 in standard conditions: 0 °C; 101.325 kPa. Basic technical data apply for standard conditions in accordance with specification. The recommended minimum continuous efficiency is 50 % of nominal efficiency. The listed technical data are based on standard conditions under DIN ISO 3046-1. With nominal velocity and in standard conditions ICFN in accordance with DIN-ISO 3046 and DIN 6271; (1) With p. f. = 1.0 under VDE 0530 REM / IEC 34.1 with relative tolerance; (2) In accordance with DIN-ISO 3046 and DIN 6271, or with permitted deviation of +/- 5 %. The tolerance for useful heat output

INDOP 145T	INDOP 150M	INDOP 160T	INDOP 170T	INDOP 190T	INDOP 210T	INDOP 210M	INDO P265M	INDOP 420M	INDOP 500M	DEMAND
144	150	159	173	193	213	210	265	420	550	From 300 kW to 10 MW
135	**143**	**149**	**166**	**185**	**204**	**201**	**252**	**401**	**523**	-
215	**207**	**220**	**210**	**219**	**241**	**263**	**321**	**513**	**648**	-
392	392	433	436	471	519	538	680	1045	1341	-
TEDOM TP 145 G5V TX 86	**MAN E 2876 E 312**	**TEDOM TP 160 G5V TW 86**	**TEDOM TG 170 G5V TW 86**	**TEDOM TG 190 G5V TW 86**	**TEDOM TG 210 G5V TW 86**	**MAN E 2876 LE302**	**MAN E 2848 LE322**	**MAN E 2842 LE322**	**MAN E 3262 LE202**	**JENBACHER / MWM**
6	6	6	6	6	6	6	8	12	12	-
11946 cm^3	12820 m^3	11946 cm^3	11946 cm^3	11946 cm^3	11946 cm^3	12820 cm^3	14620 cm^3	21930 cm^3	25800 cm^3	-
36.7	38.4	36.÷7	39.8	41.0	41.0	39.0	39.0	40.2	41.0	-
54.8	52.8	50.7	48.1	46.4	46.4	48.9	47.2	49.1	48.3	-
91.5	**91.2**	**87.4**	**87.9**	**87.5**	**87.4**	**87.9**	**86.2**	**89.3**	**89.3**	-
3000	3000	3100	3200	3200	3400	3600	5000	5500	6000	-
3.3x1.2x2.2	3.3x1.2x2.2	3.3x1.2x2.2	3.4x1.2x2.2	3.4x1.2x2.2	3.4x1.2x2.2	3.5x1.2x2.2	3.7x1.3x2.2	4.0x1.4x2.7	4.5x1.4x2.7	-
LPG	NG	LPG	NG/ BIOGAS*	NG/ BIOGAS*	NG/ BIOGAS*	NG	NG/ BIOGAS*	NG/ BIOGAS*	NG/ BIOGAS*	NG/ BIOGAS*

is +/- 7 %. Performance efficiency is based on a new unit (immediately after the start-up). The effects of degradation during normal operation can be mitigated by regular repair and maintenance.
* Efficiency rates of a biogas fuelled CHP unit may differ from those shown in the table. The technical data are based on the calorific value of the fuel; i.e.10 kWh/Nm^3 for natural gas and 6 kWh/Nm^3 for biogas.

Component parts



1 → Engine
2 → Heat exchanger "flue gases - water"
3 → Gas line - blocking valve
4 → Generator
5 → Accumulator
6 → Circulation pump
7 → Expansion tank
8 → Vessel with a heater
9 → Base
10 → Oil filling tank
11 → Engine cabinet
12 → Heat exchanger "refrigerant - water"
13 → Forced cooling
14 → Duct for evacuation of air from the container
15 → Container's double door
16 → Noise muffler at the exhaust point
17 → Duct for intake of air into the container
18 → Container's single door
19 → Container

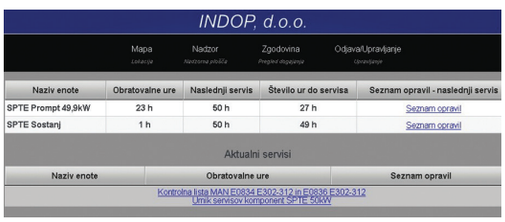
Control system

We have developed our own central control system that is crucial for proper functioning of the unit (SCADA, HMI). The system is used to collect key information on the operation of the unit and to immediately report any defects and deficiencies in the operation of the CHP unit. This allows the client and other authorised persons to automatically obtain the necessary information on the operation of their units (e.g. generated electricity and heat, achieved efficiency rates, fuel consumption, errors during operation, etc.).

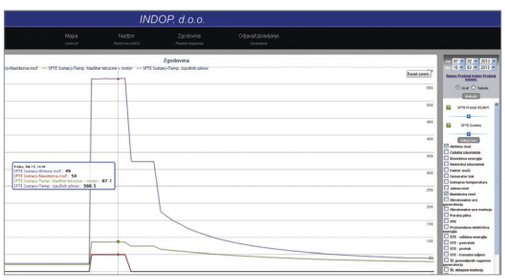
→ Own control system for proper operation of the unit

CHP unit

Transfer of data to the central control centre

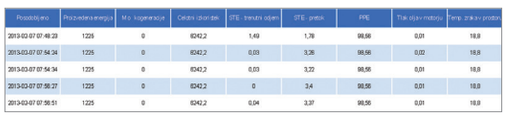


Clear display of operation of the units, errors and deficiencies during operation, assistance in elimination of errors, repair intervals



Operation analysis

Automatic notification system

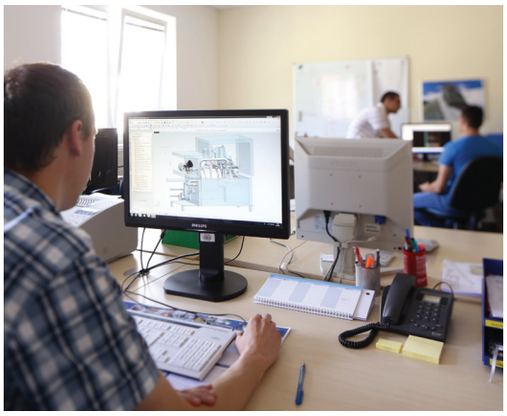


Automatic reporting system

Engineering

We offer you implementation engineering which comprises the following:

- preparation of the comprehensive design documentation (Design for Building Permit Acquisition, Detail Design, Design of Carried-Out Works),
- elaboration of feasibility assessment,
- feasibility study,
- preparation of investment documentation,
- technical counselling,
- installation of mechanical devices and installations.



Maintenance service

Besides highly efficient CHP units, we offer you maintenance service throughout their entire operational life. To this purpose, we offer you the option of concluding a maintenance service contract for the period of up to 10 years.

An essential feature for proper and faultless operation of a CHP unit is the unit's own control system responsible for immediate reporting of errors and deficiencies in operation. Besides maintenance, we also offer original spare parts. Our maintenance service technicians are highly trained experts offering fast and quality service 24 hours a day, 365 days a year.

→ Maintenance service throughout the entire operational life

Why choose us?

- We are the only company in Slovenia with own production of CHP units,
- we have our own development of CHP units and
- own remote controlling system for CHP units,
- we market our product,
- we offer implementation engineering
- we provide our own maintenance service.

We offer you development and production of CHP units adapted exclusively to your wishes and needs.

We are certain that together with our experts you will find the right solution.

References

→ The only company in Slovenia with own production of CHP units

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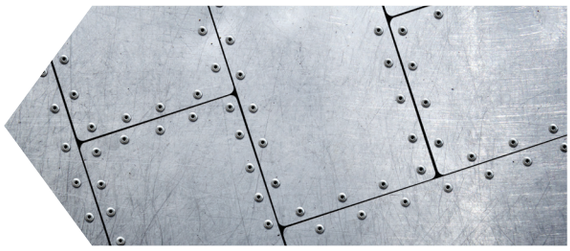

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