



Extruder Modification: Debottlenecking & Upgrades

Hans-Peter Neuberger – Managing Director Coperion Japan

Coperion Technology Update 2025

Aftermarket Sales & Service Division



For longtime reliable processes: A worldwide service net

Innovative services for any industry (1/2)

- Most comprehensive service network in the industry
- Over 450 experienced service technicians and service engineers worldwide
- Emergency service
- Spare parts, incl. emergency stock
- Maintenance & repair
- Modernization to increase output, efficiency, and safety and to save energy consumption of a production system
- Predictive maintenance and increase of OEE with C-Beyond
- Remote services for easy start-up and operation



Aftermarket Sales & Service Division



For longtime reliable processes: A worldwide service net

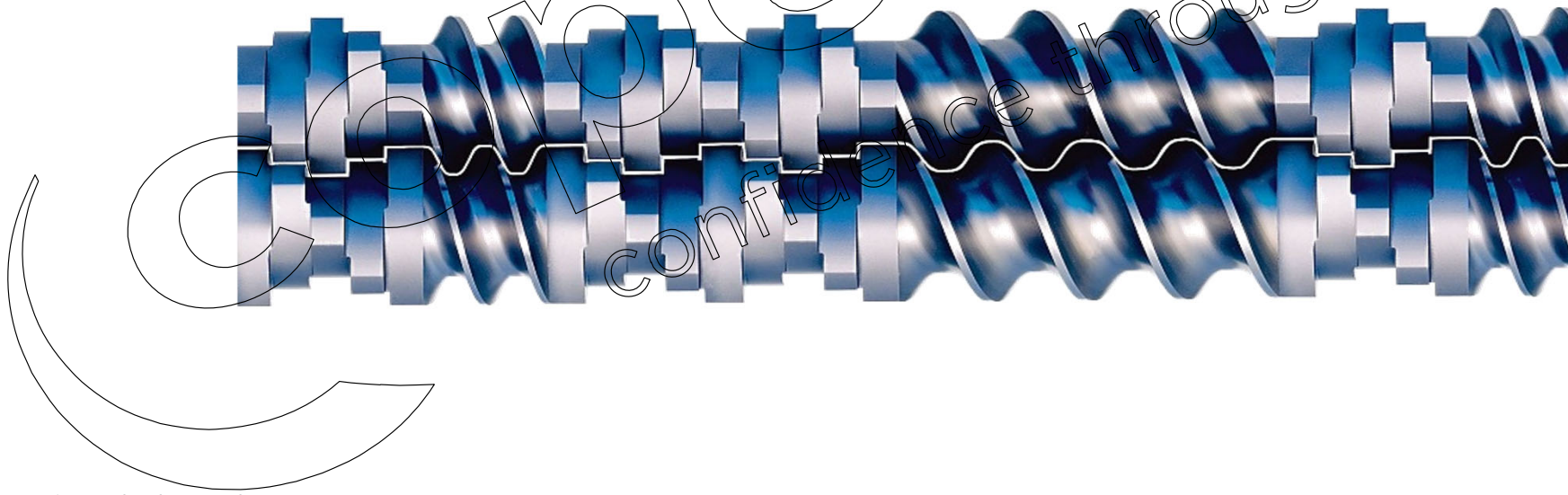
Innovative services for any industry (2/2)

- Site management
- Service consulting
- Service agreements
- Comprehensive range of trainings
- Test Centers worldwide for a wide range of processes
- 30 years data archiving

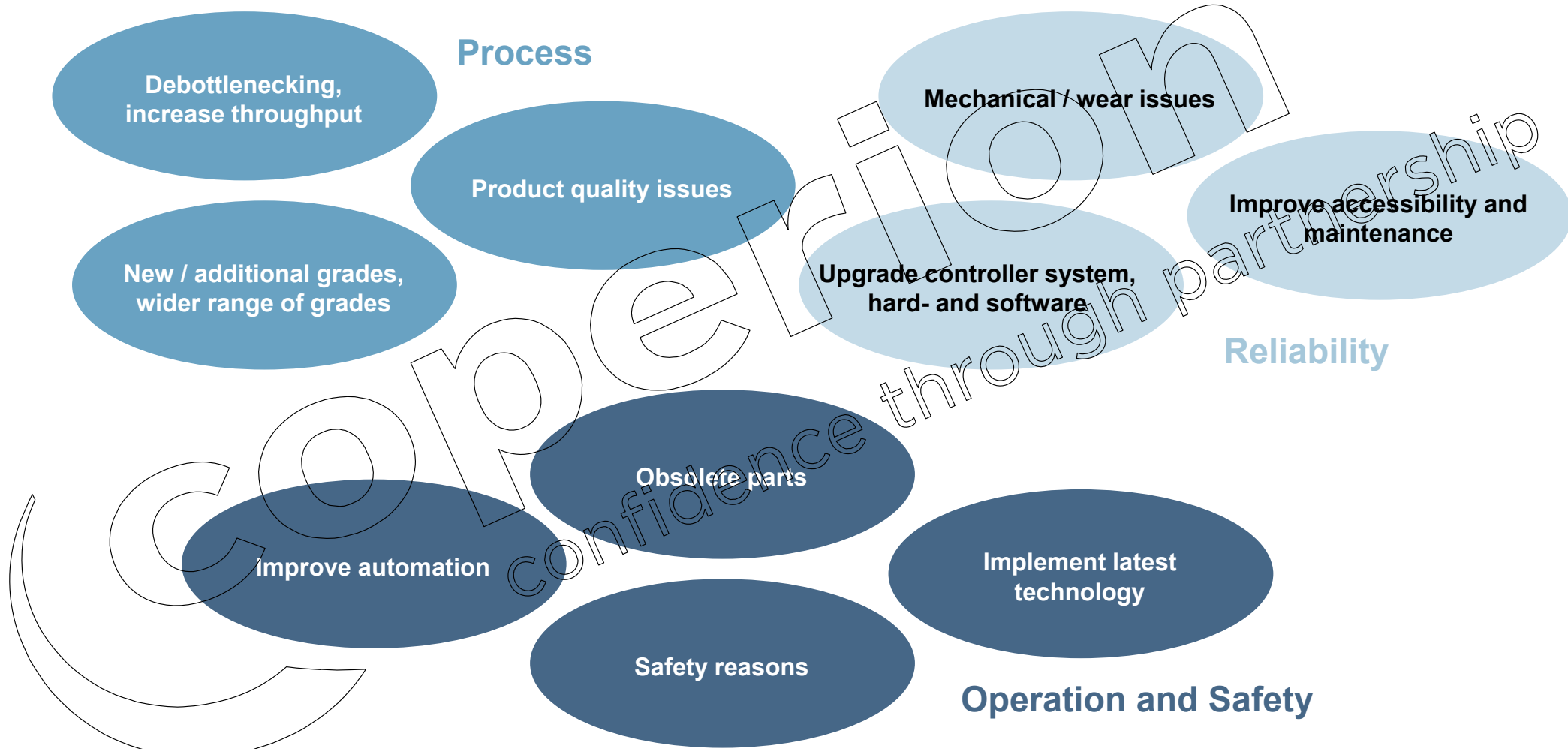


Extruder Modernization

The objectives of modernization are to achieve maximum productivity in conjunction with maximum availability, operational reliability and safety



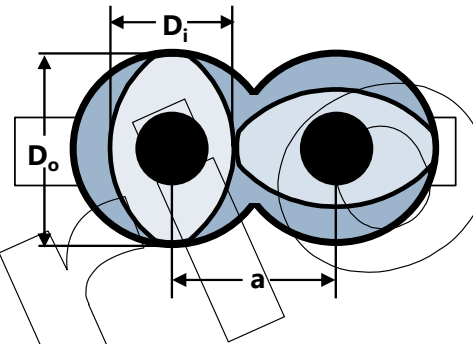
Modernization – Why?



Extruder History

Development of extruders over the last 65 years

In year 1959 Werner & Pfleiderer (Coperion) developed the first twin screw extruder



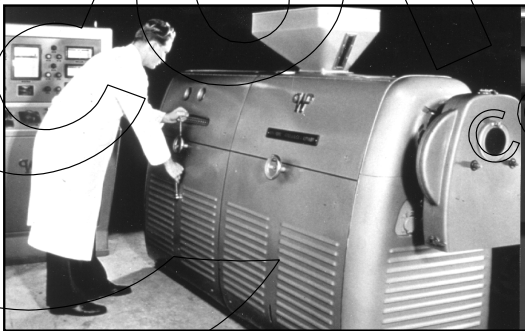
>> Year 1958

$$D_o / D_i = 1,22$$

$$M_d / a^3 = 5,0 \text{ Nm/cm}^3$$

Example: ZSK120 (a=110mm)

HDPE rate **500 kg/h**



to

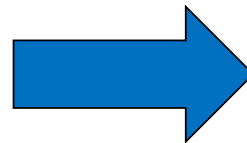
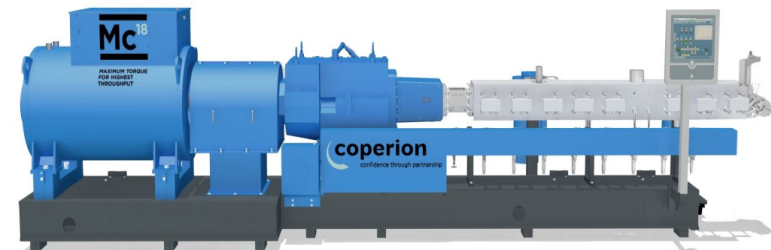
Year 2007

$$D_o / D_i = 1,55$$

$$M_d / a^3 = 12,5 \text{ Nm/cm}^3$$

ZSK 133 (a=110 mm)

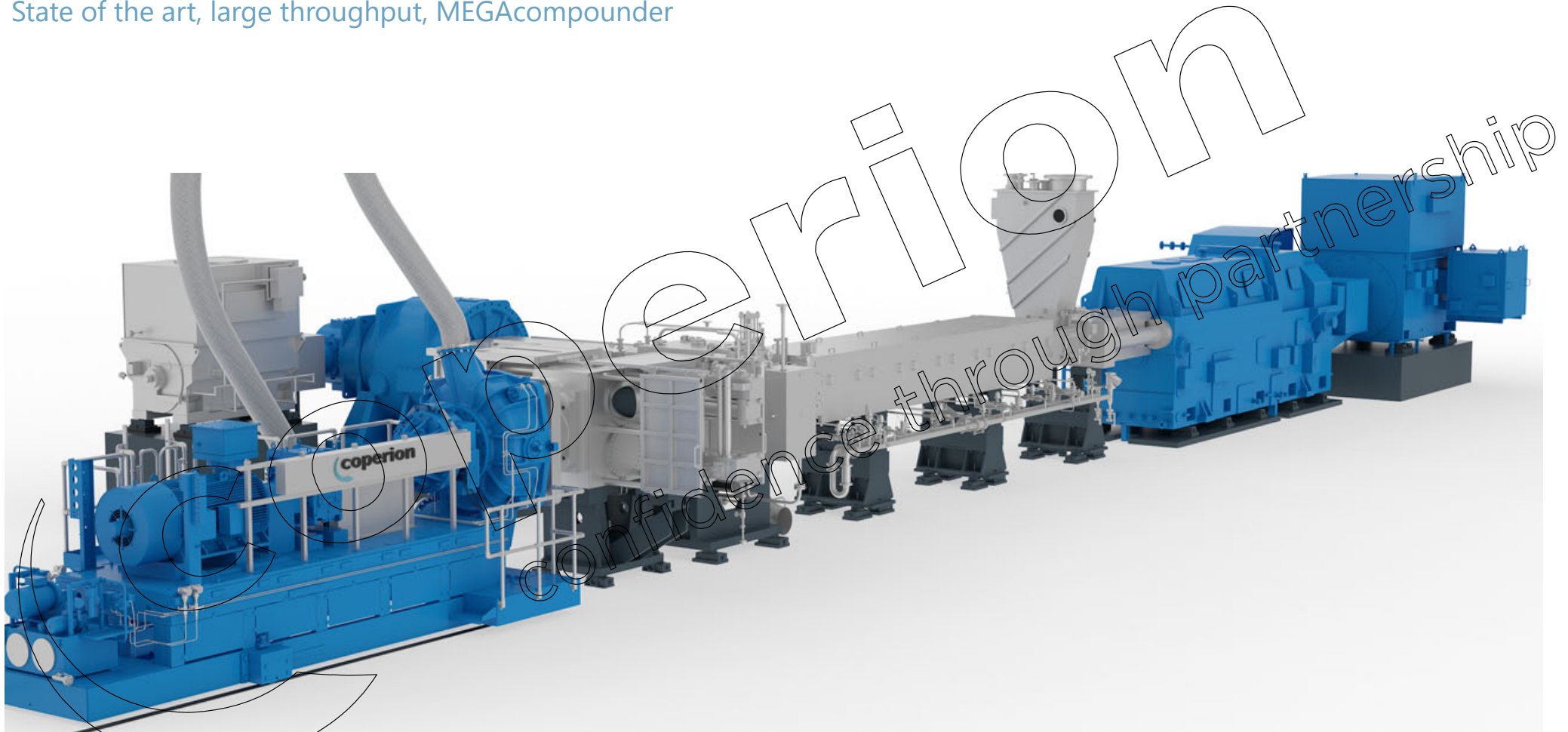
12.500 kg/h



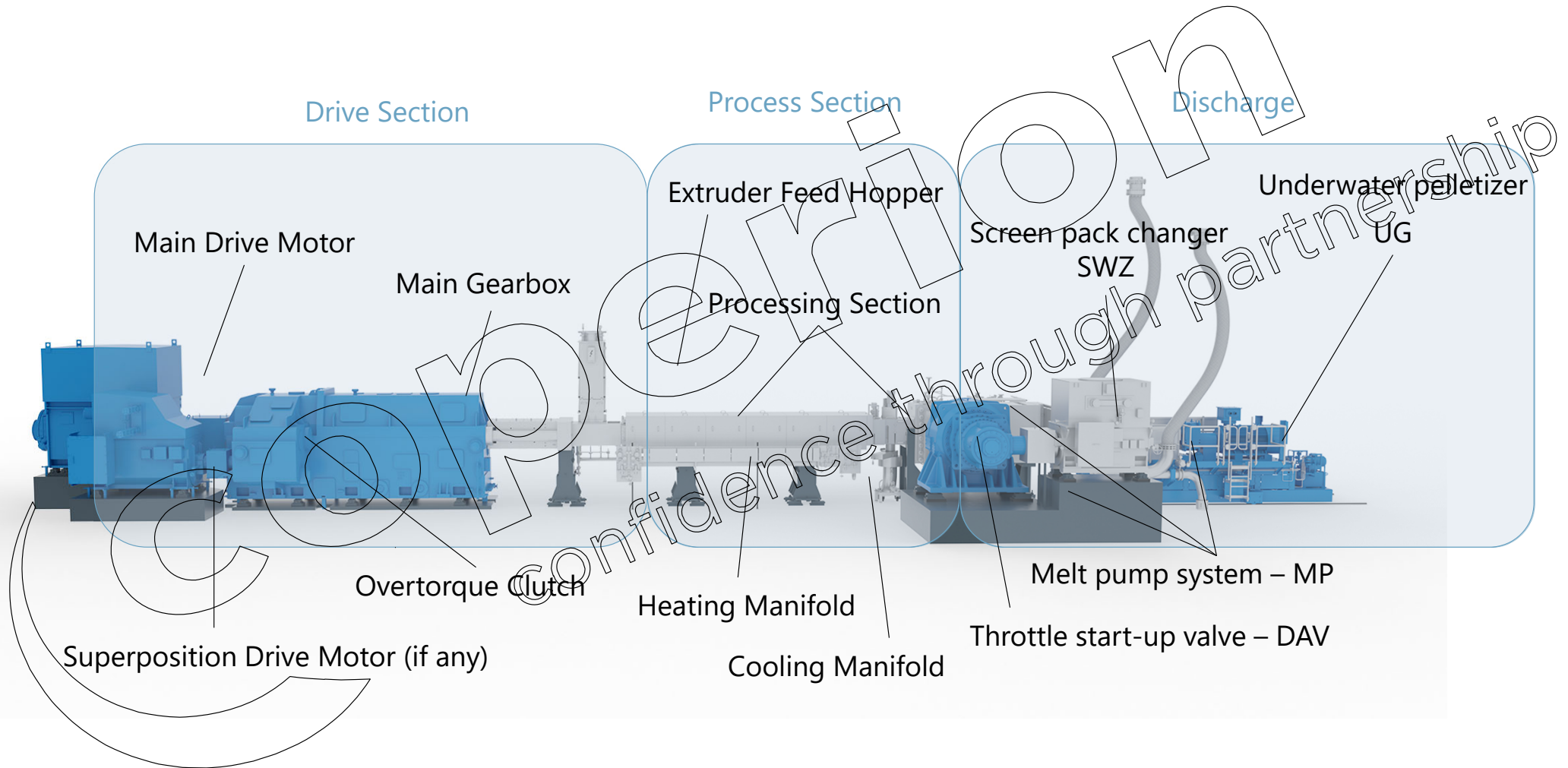
by factor 25

Complete Extrusion System

State of the art, large throughput, MEGAcoupler



Complete Extrusion System



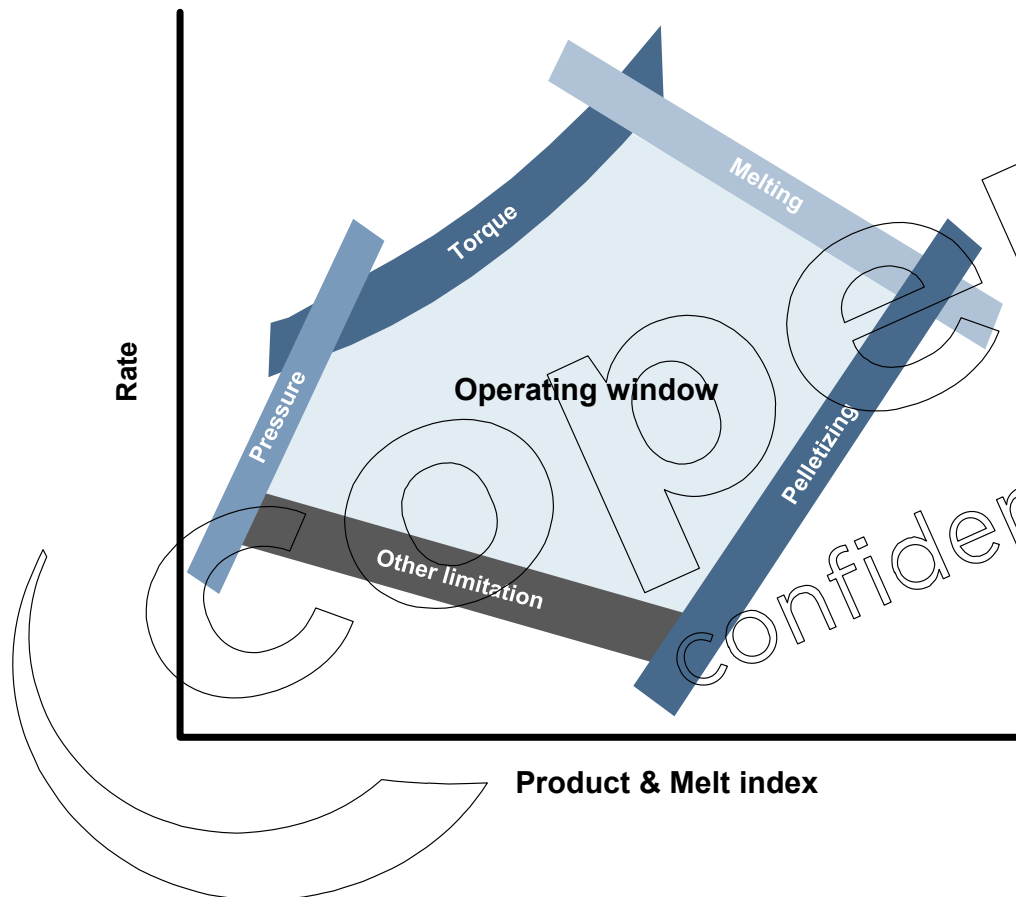
Where Are the Limitations of an Extrusion System?

Process limitations go mostly hand in hand with physical limitations

Pressure limits:	Extruder, screw pack changer, die-plate
Temperature limits:	Extruder, die-plate, heat exchanger
Power limits:	Motors, drive systems, auxiliary equipment
Torque limitation:	Coupling, gearbox, screw shafts

Extruder Modernization

Consideration for upgrading existing extrusion lines



The product, the parameters, the process-related dependencies and the machine components must be taken into account, and the mutual influence.

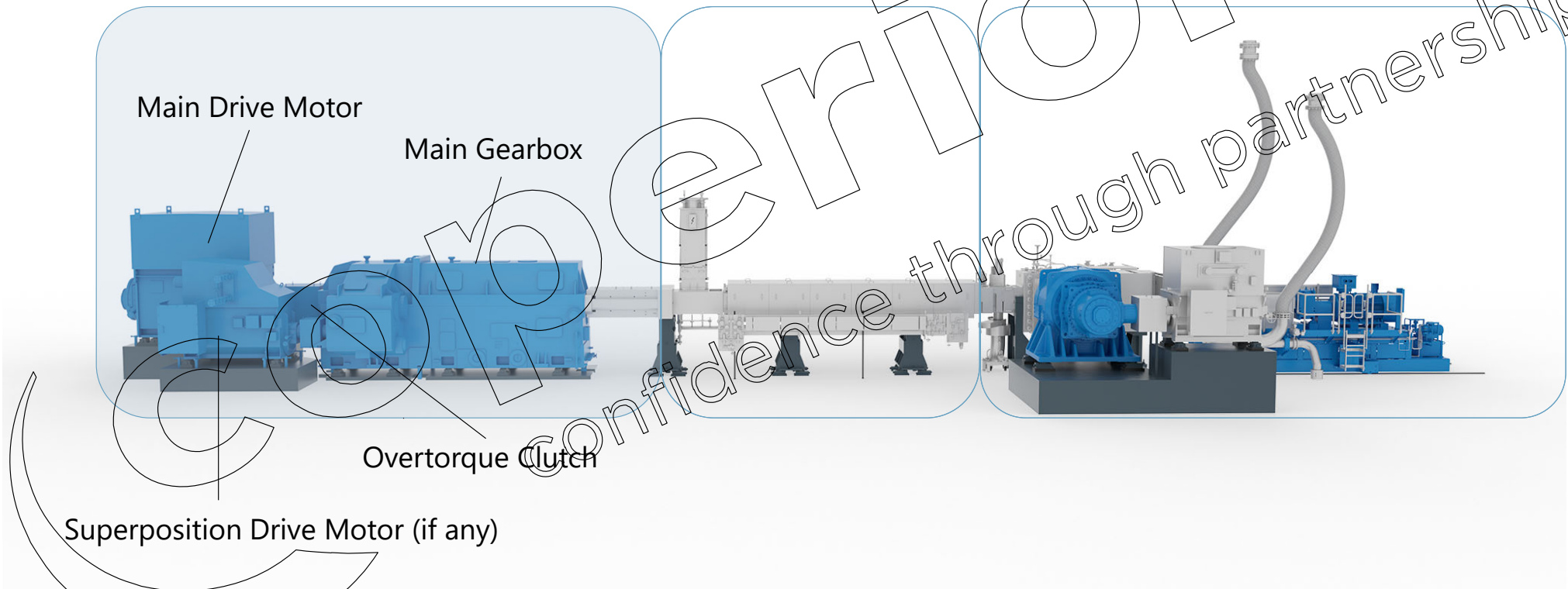
Extruder Modernization

- 1 Drive section
- 2 Extruder
- 3 Discharge
- 4 Controller System
- 5 Auxiliary Equipment / Pellet After Treatment

Drive System

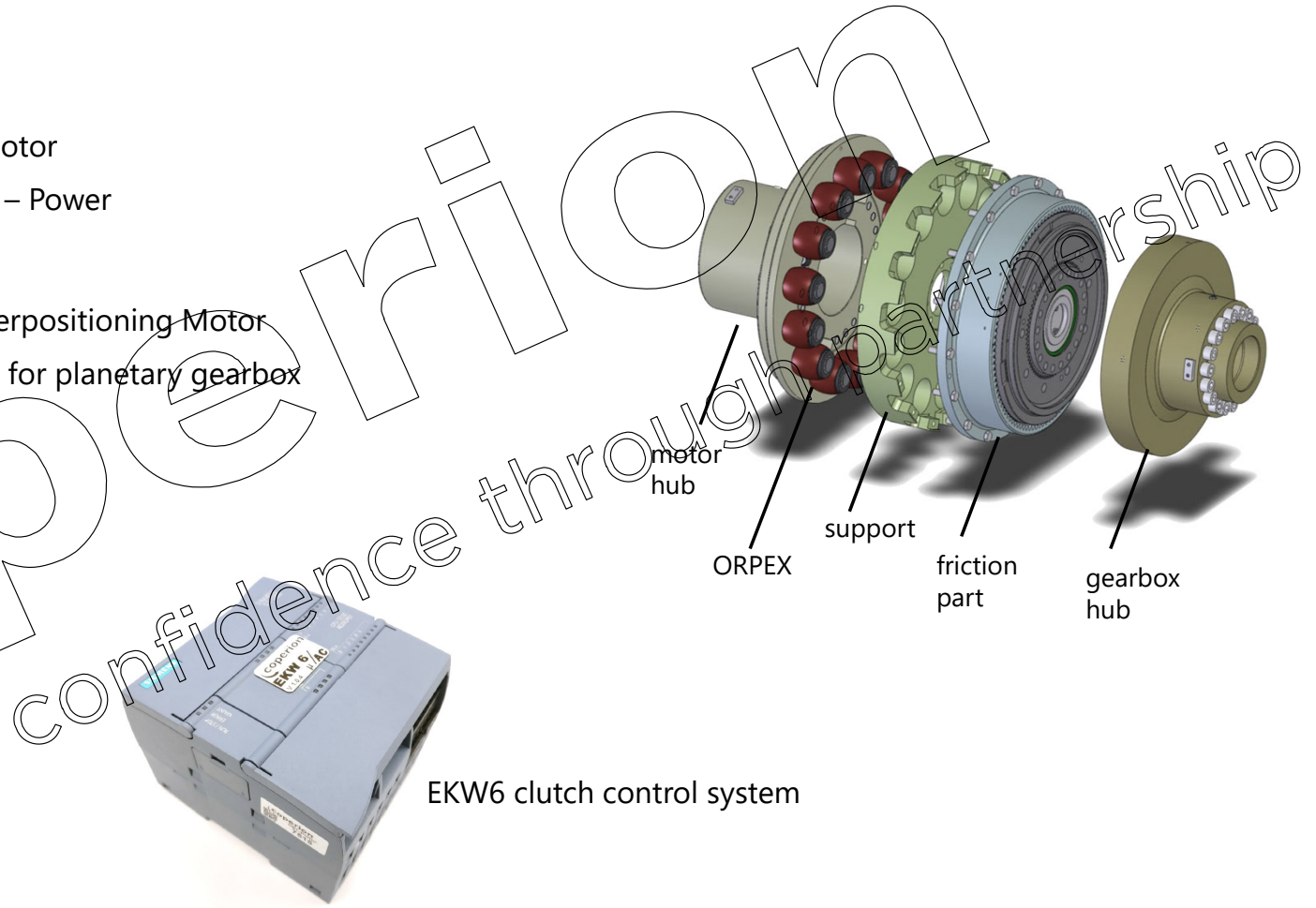
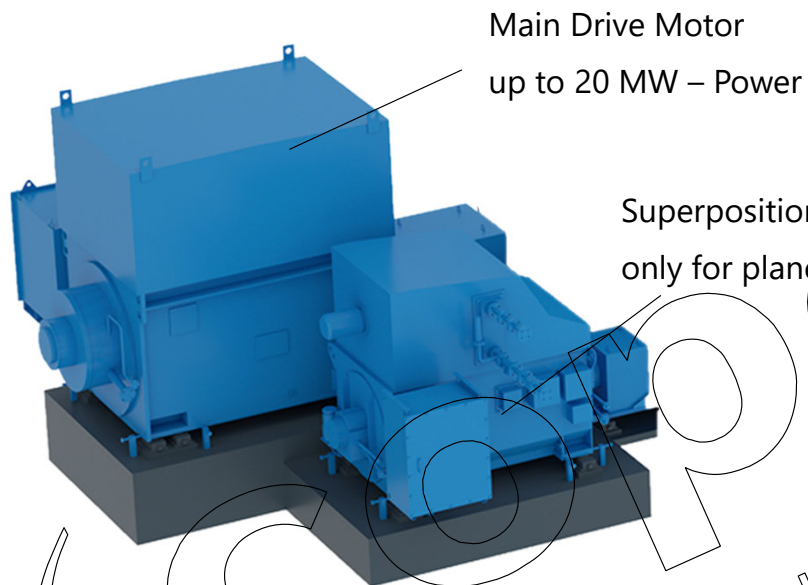
Motor, clutch and gearbox

Drive Section



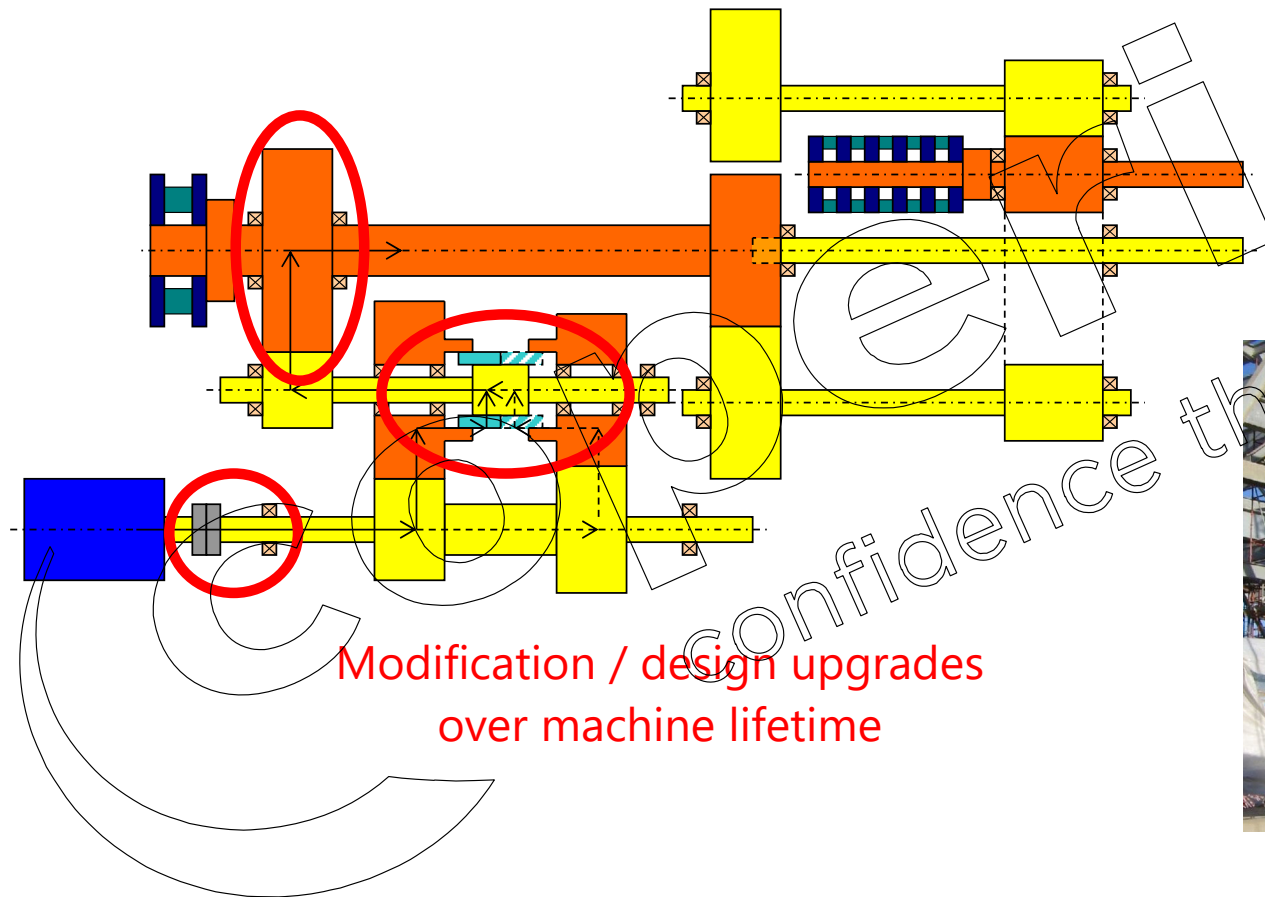
Drive System

Motor, clutch and gearbox

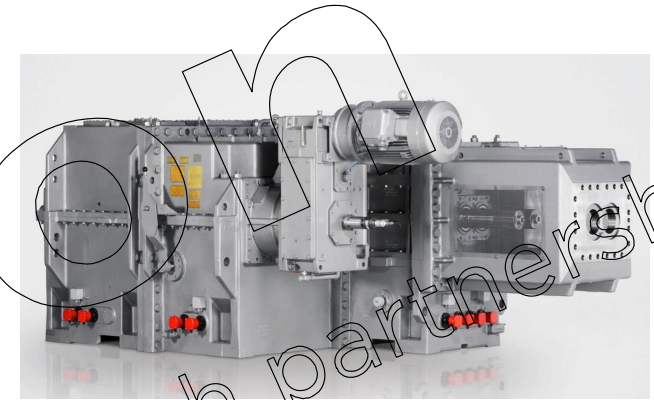


Main Gearbox

Spur gearbox for ZSK 177 – ZSK 350



Modification / design upgrades
over machine lifetime



Main Gearbox

Complex system



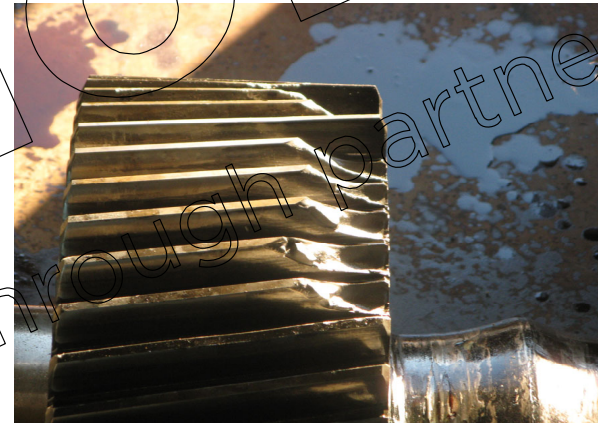
Main Gearbox

Gearbox damages because of missing upgrades or poor maintenance



Broken outer race

Gear breakage



Gear breakage

Potential Modification

Drive Section

Motor:	Increase power (KW) to increase throughput
Motor:	Install variable speed drive to increase process efficiency
Coupling:	Increase transmittable torque (Nm) to increase throughput
Coupling :	Install EKW6 to increase reliability
Gearbox:	Change speed (gear ratio) to increase efficiency or throughput
Gearbox:	Modify to single speed to increase reliability
Gearbox:	Install bearing in latest design and material to improve reliability / lifetime
Gearbox:	Modify design of gears and shafts to increase reliability

Process Section

Extruder

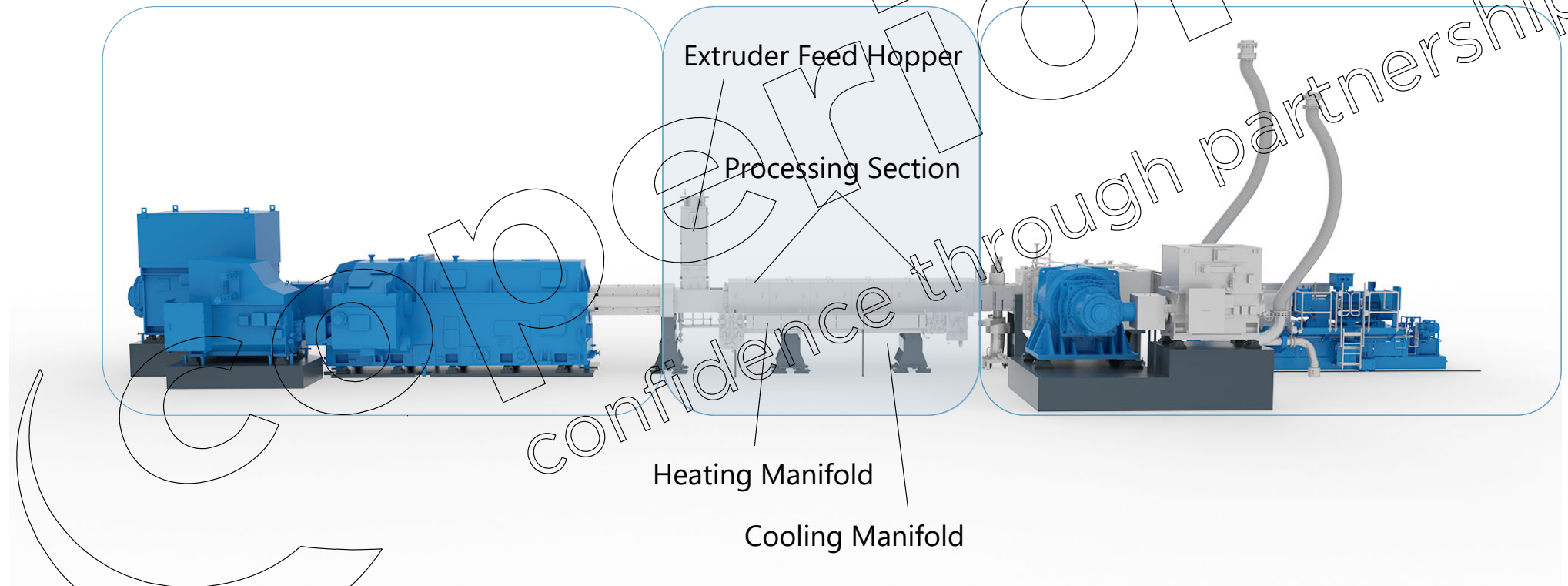
Process Section

Extruder Feed Hopper

Processing Section

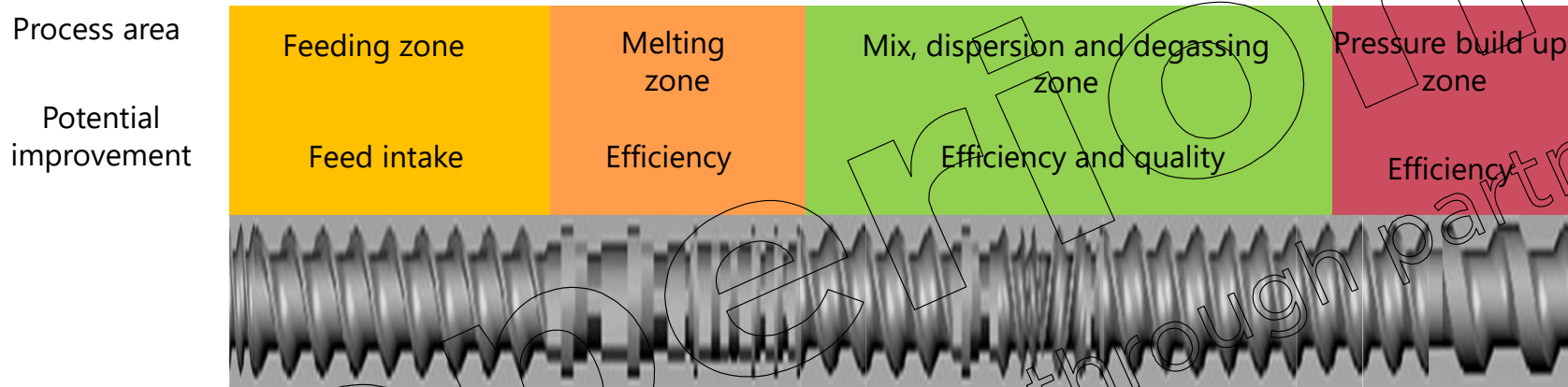
Heating Manifold

Cooling Manifold

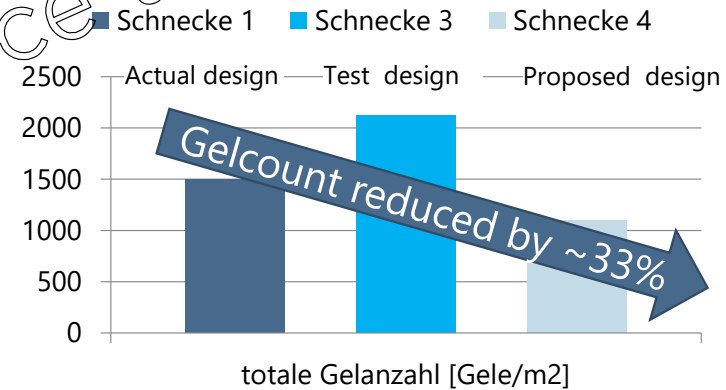
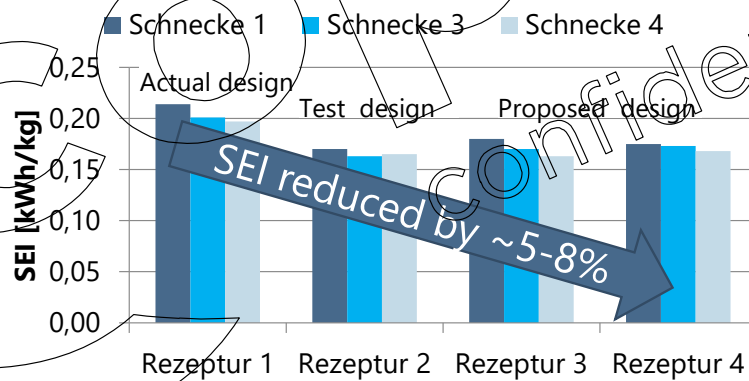
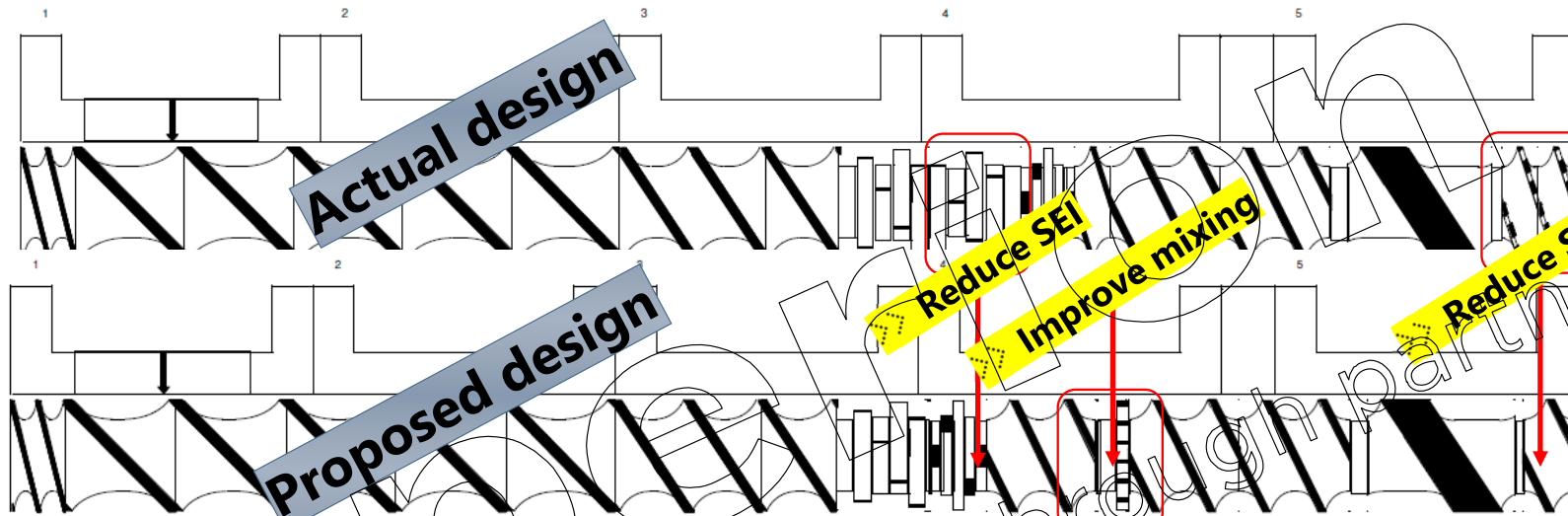


Process Section

Extruder



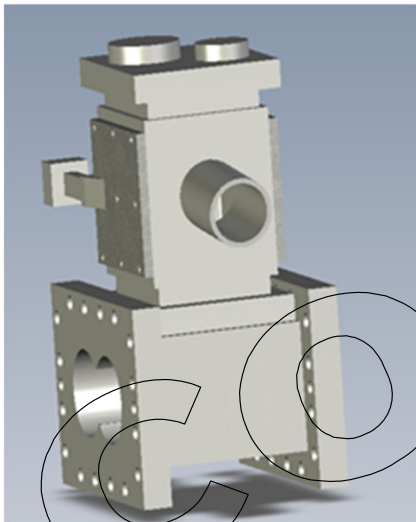
Process Section: Example of Optimisation



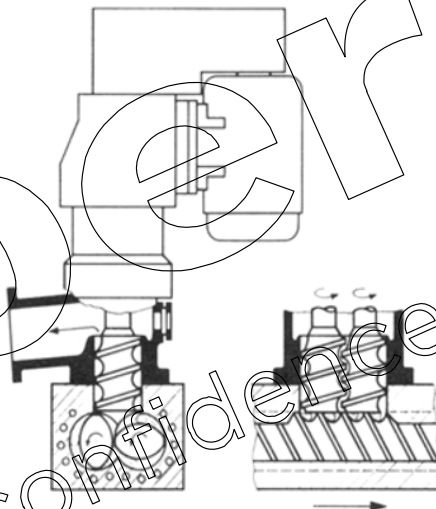
Twin Screw Side Degassing

Development

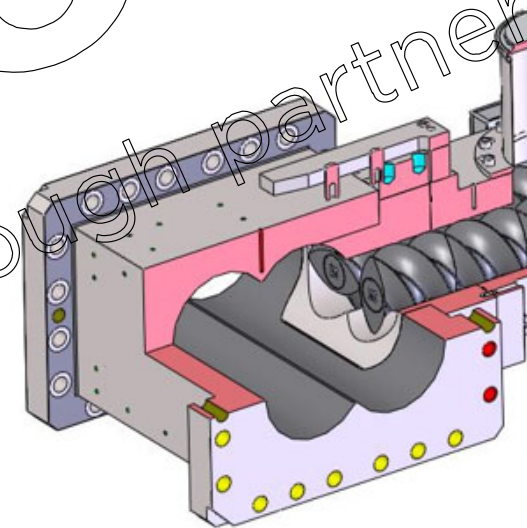
Vacuum degassing



Degassing screw on top



Twin screw side degassing

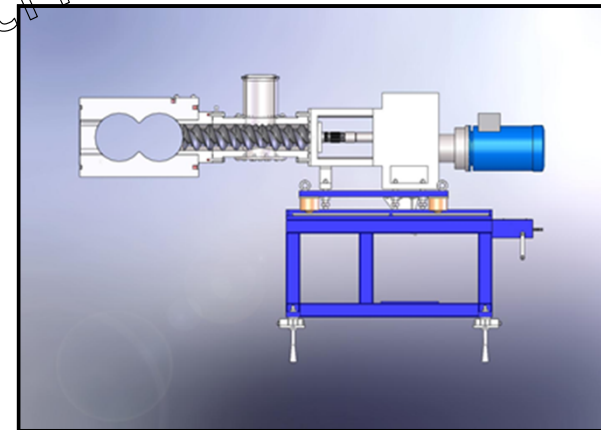
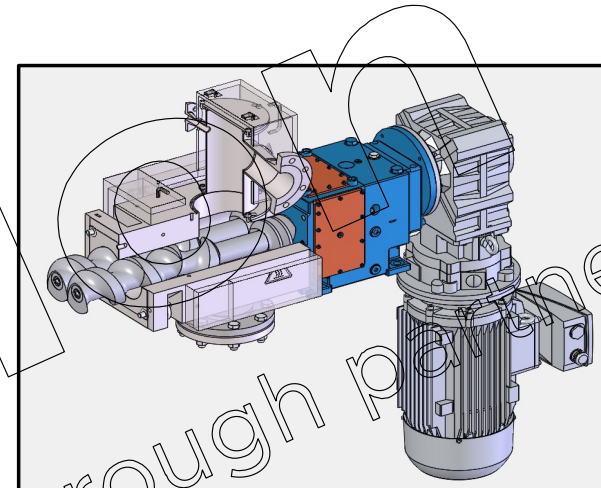


Depending on grades filling degree increase approx. 15% to 30%

Twin Screw Side Degasing

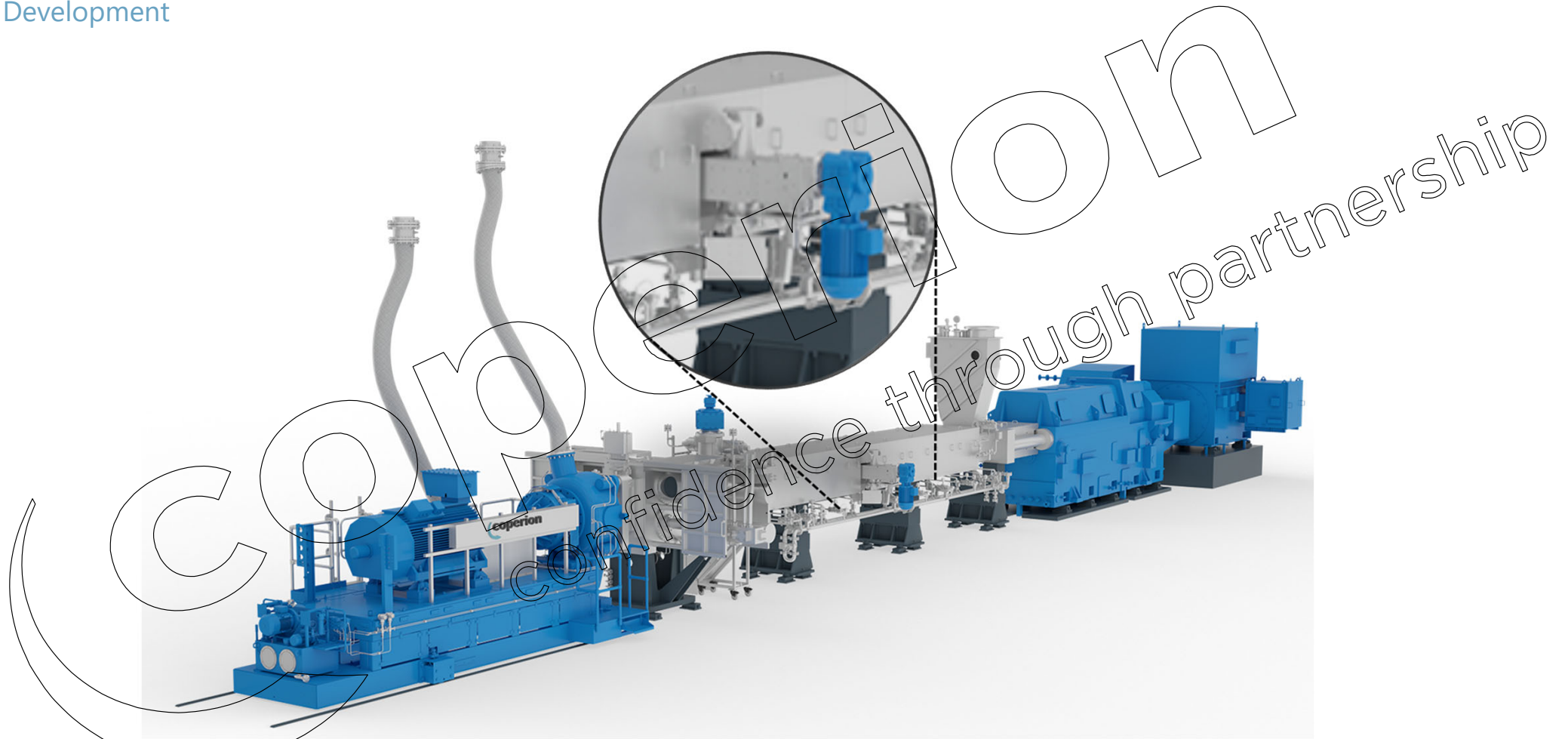
Features of ZSEG / Twin Screw Side Degasing

- High efficiency, especially at low RPM
- Variable speed
- Retrofittable!
- ATEX Version available
- No contamination by degraded polymer
- Different sizes available
- Material of construction: wear and corrosion resistant screw elements
- Kombiblock barrel insert
[quick change, main extruder barrel does not need to be removed]



Twin Screw Side Degasing

Development



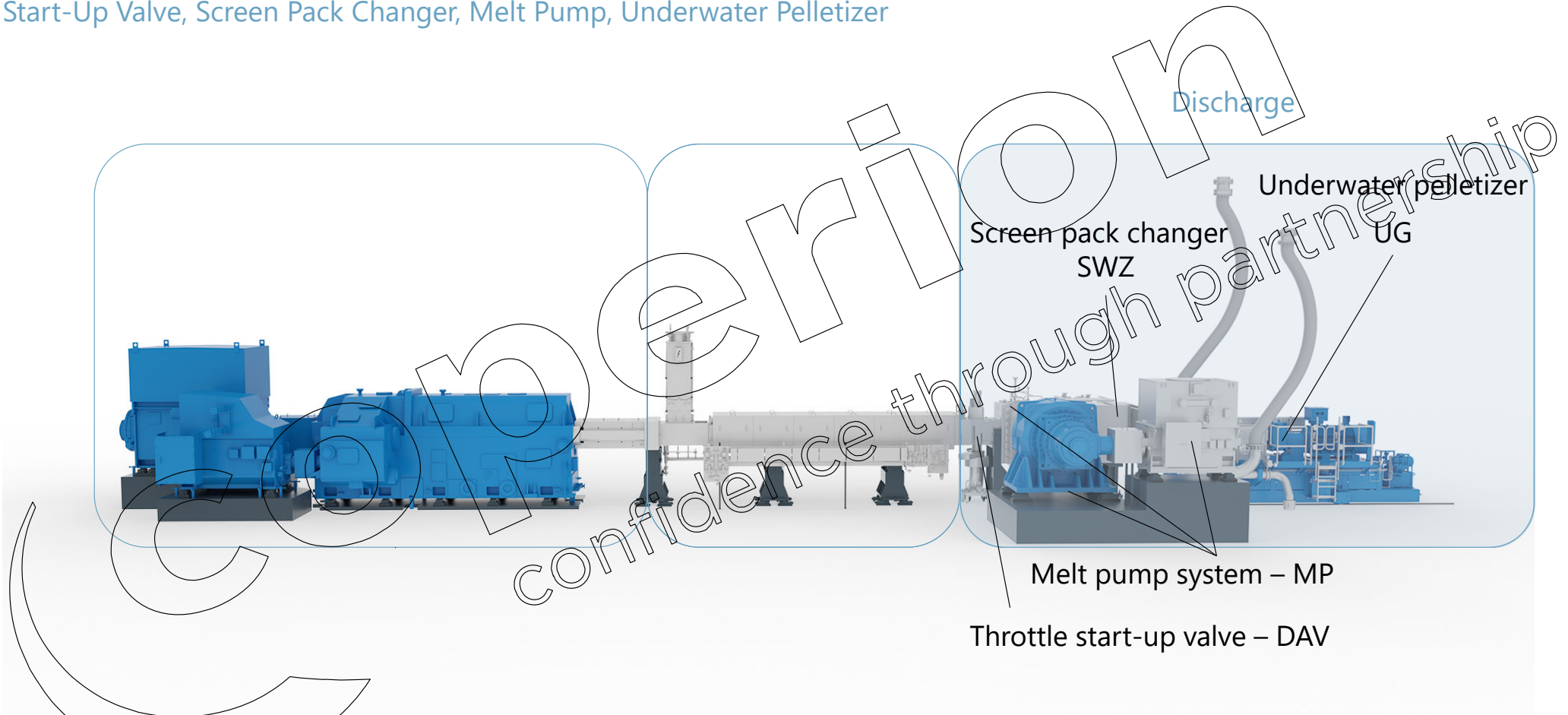
Potential Modification

Process Section / Extruder

Feed hopper:	Improve venting for higher throughput
Feed zone extruder:	Improve screw configuration for higher throughput
Extruder:	Optimize screw configuration for high throughput and / or energy saving
Extruder:	Optimize screw configuration to improve product quality
Extruder:	Install ZSEG to improve product quality and / or increase throughput
Extruder:	Change wear material of screw elements and barrels to increase the lifetime

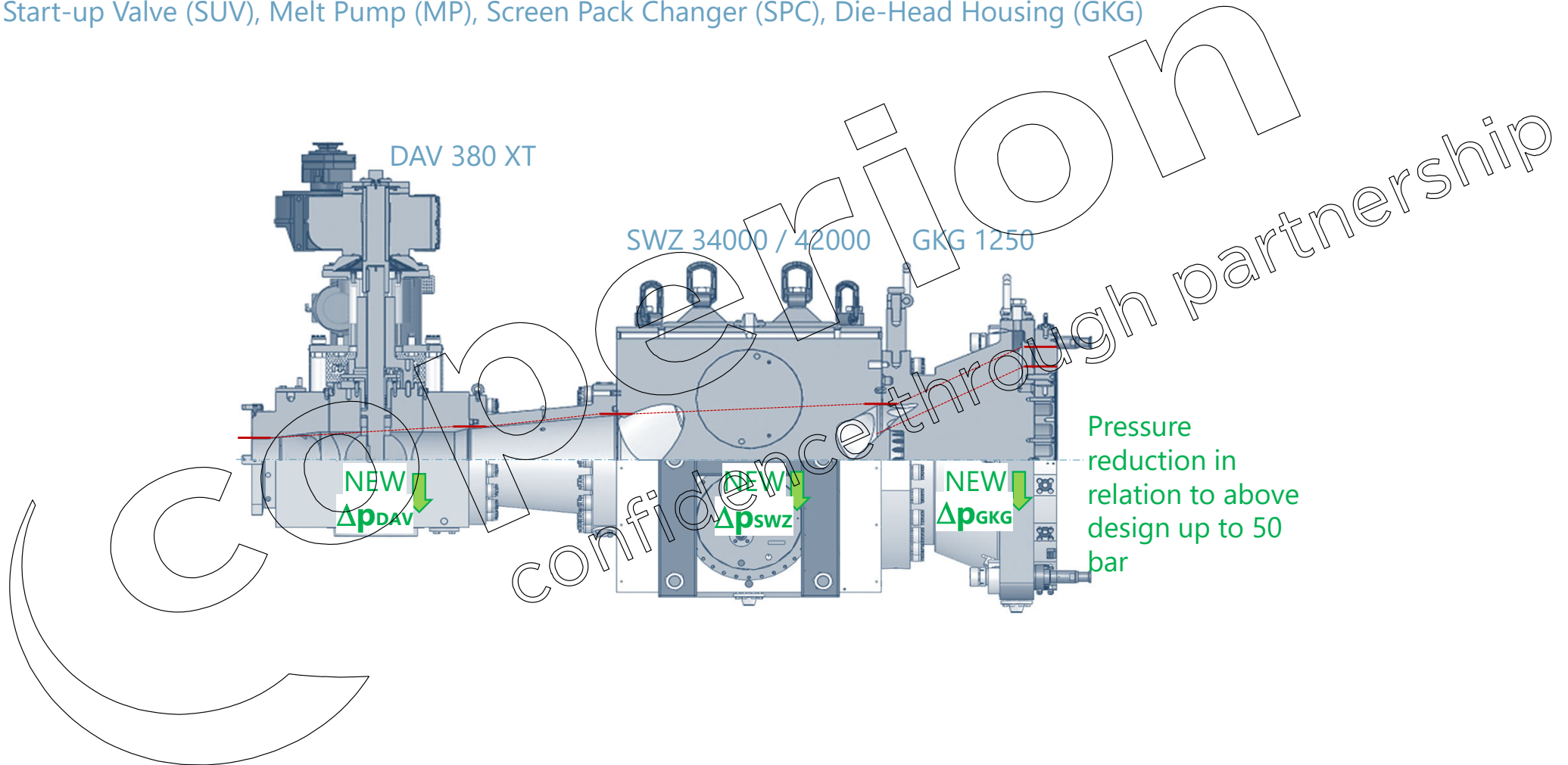
Discharge Equipment

Start-Up Valve, Screen Pack Changer, Melt Pump, Underwater Pelletizer



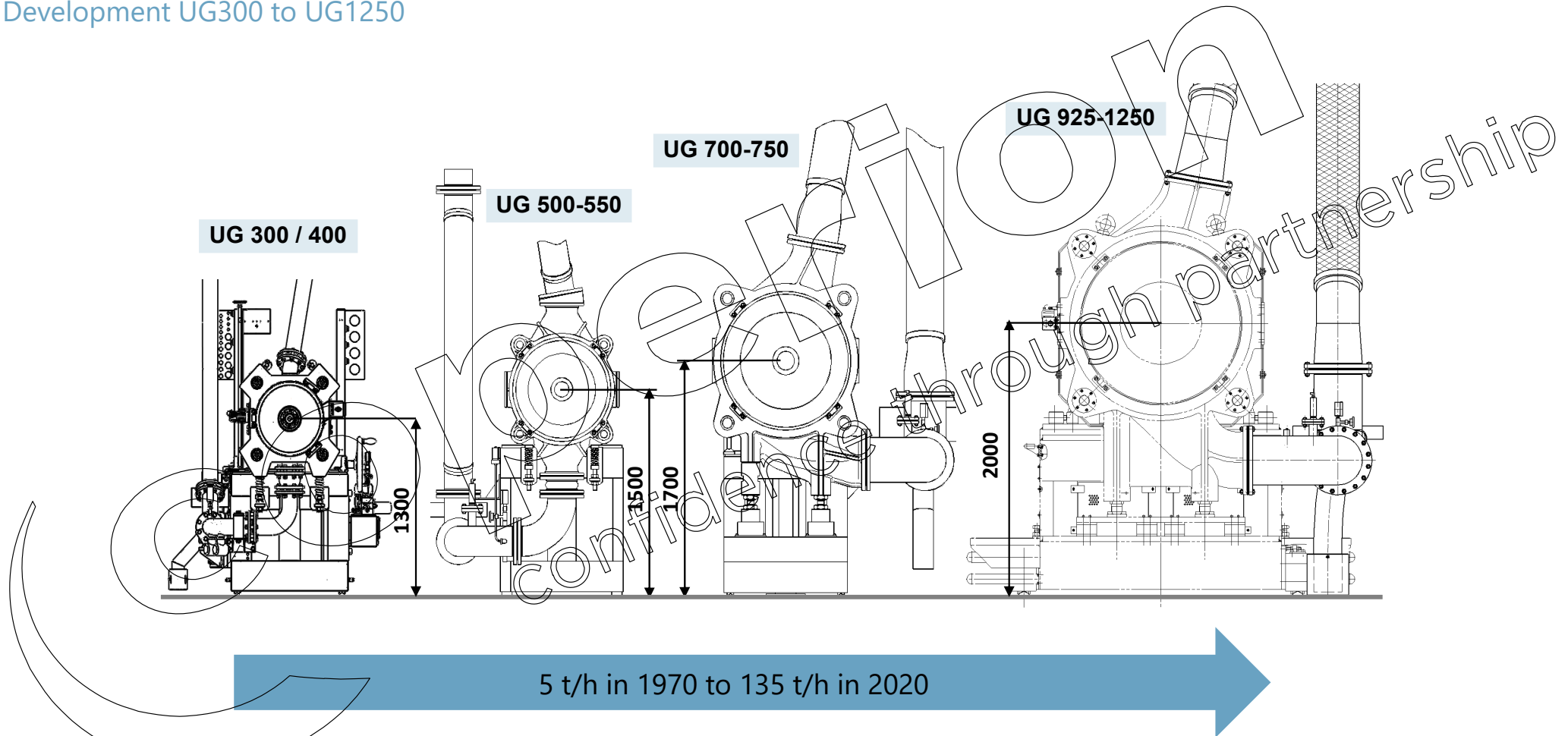
Discharge Equipment

Start-up Valve (SUV), Melt Pump (MP), Screen Pack Changer (SPC), Die-Head Housing (GKG)



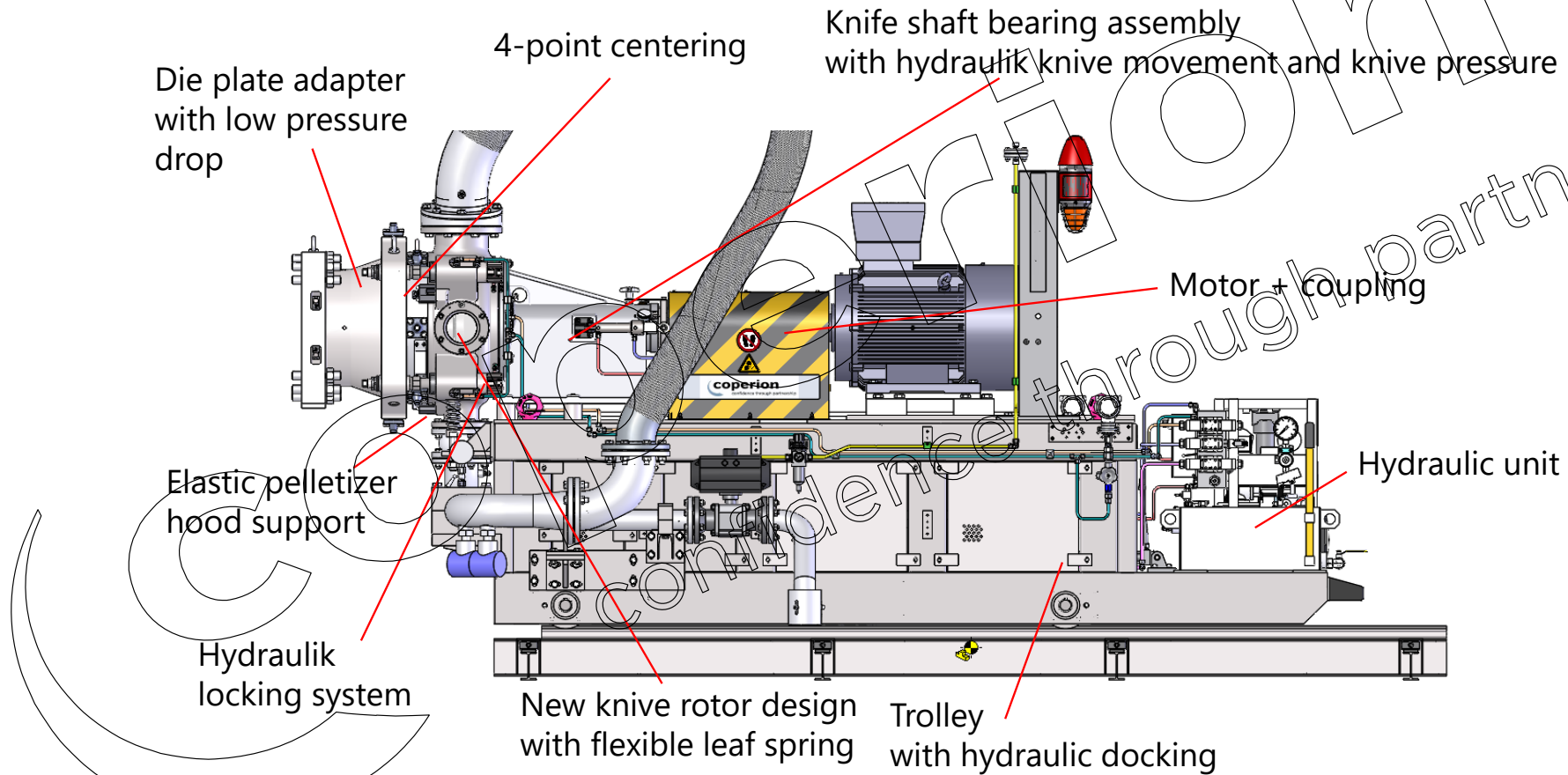
Underwater Pelletizer

Development UG300 to UG1250



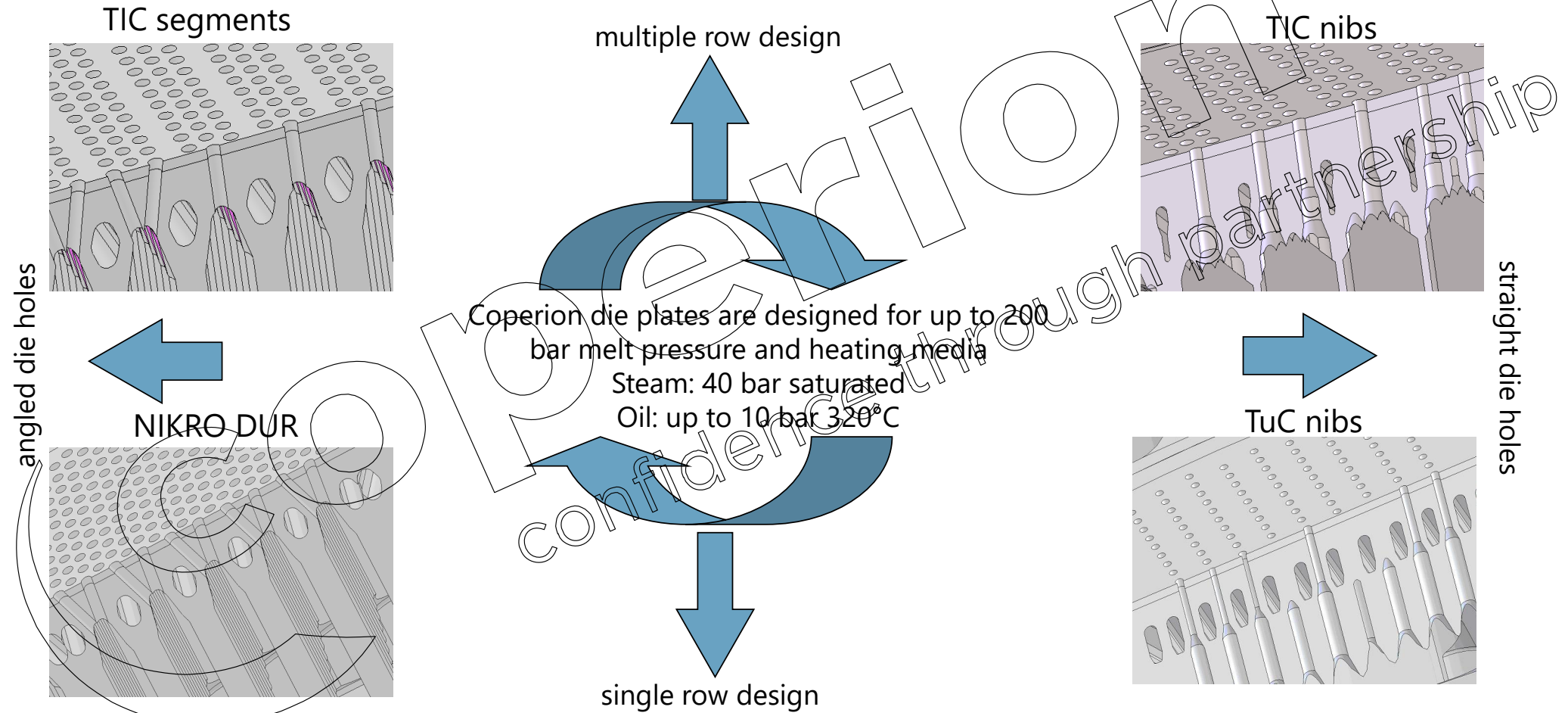
Underwater Pelletizer

Features actual pelletizer



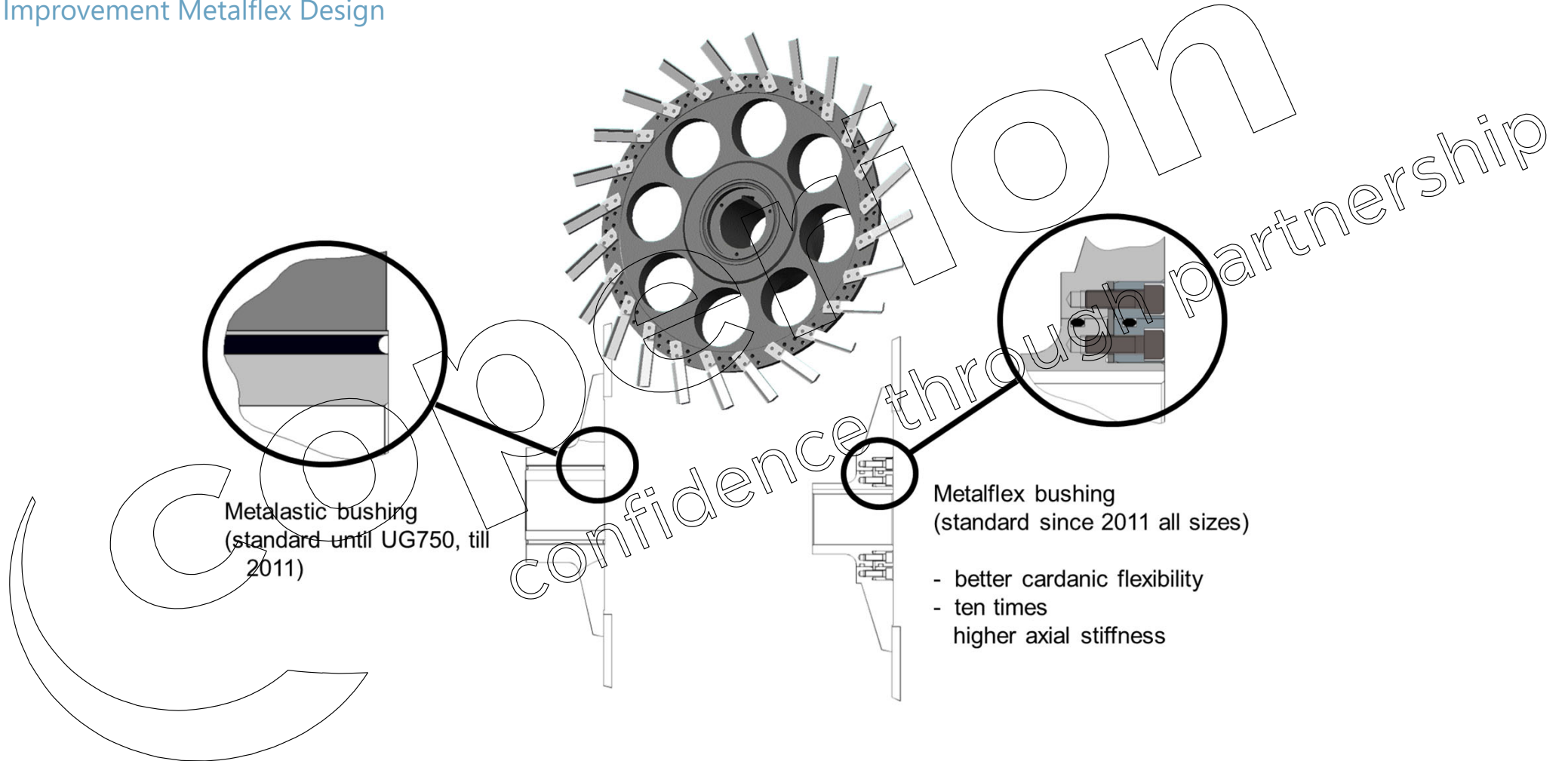
Coperion Die-Plate Design Options

Our manufacturing allows the most flexible die-plate design in the market



Knife Holder

Improvement Metalflex Design



Metalastic bushing
(standard until UG750, till
2011)

Metalflex bushing
(standard since 2011 all sizes)

- better cardanic flexibility
- ten times
higher axial stiffness

Our Complete Pellet Cutting Solution Offer



- Basics on pellet cut quality
- Coperion under water pelletizers (UG)
- Coperion **die-plates** update
- Coperion **knife rotor systems** and **knives**



Potential Modification

Discharge

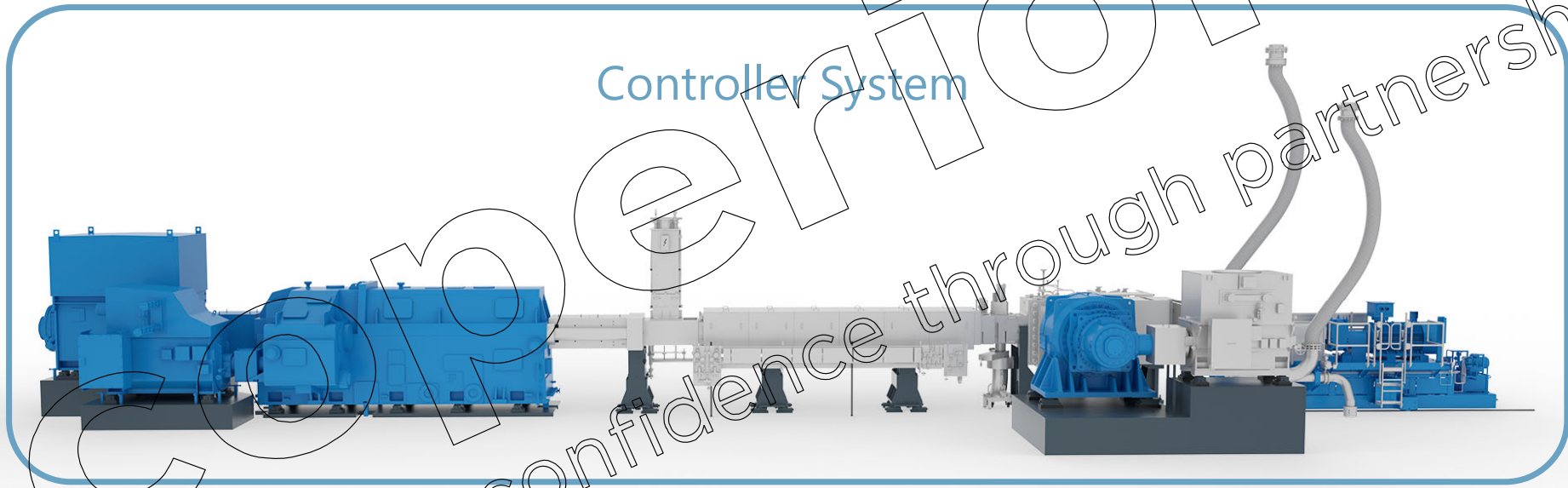
SUV, SPC, GKG:	New design to reduce pressure losses. Increase throughput and/or energy saving
Melt pump:	Improve cooling design to increase throughput and/or quality
Underwater pelletizer:	Improve design to increase reliability, automation and safety
Die-plate:	Improve design to increase throughput and / or pelletizing quality
Die-plate:	Install die-plate with latest wear protection material to increase lifetime
Knife holder:	Install latest design to increase reliability and pelletizing quality
Pelletizer knives:	Install knives with latest wear protection material to increase lifetime

Complete Extrusion System



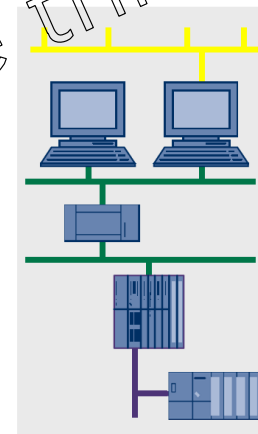
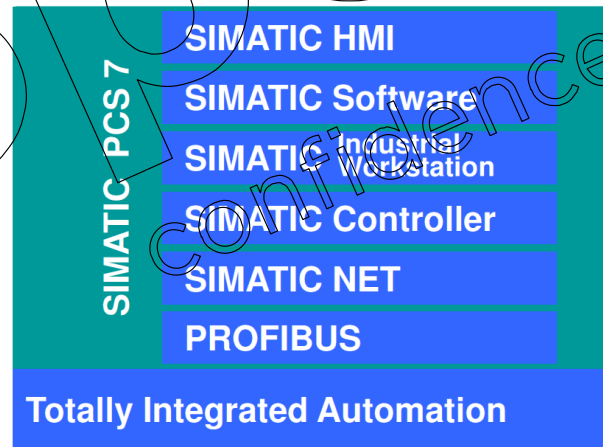
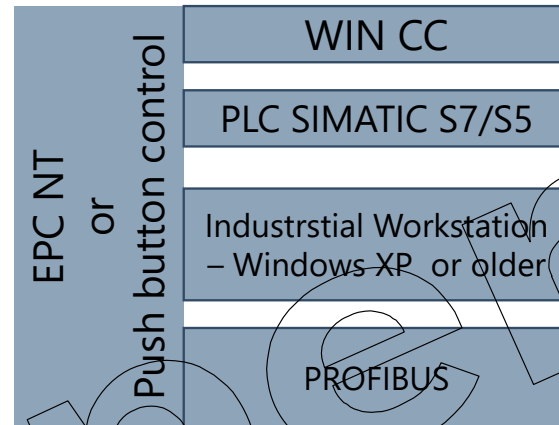
Controller System

Controller System



Potential Modification

Controller System



Components

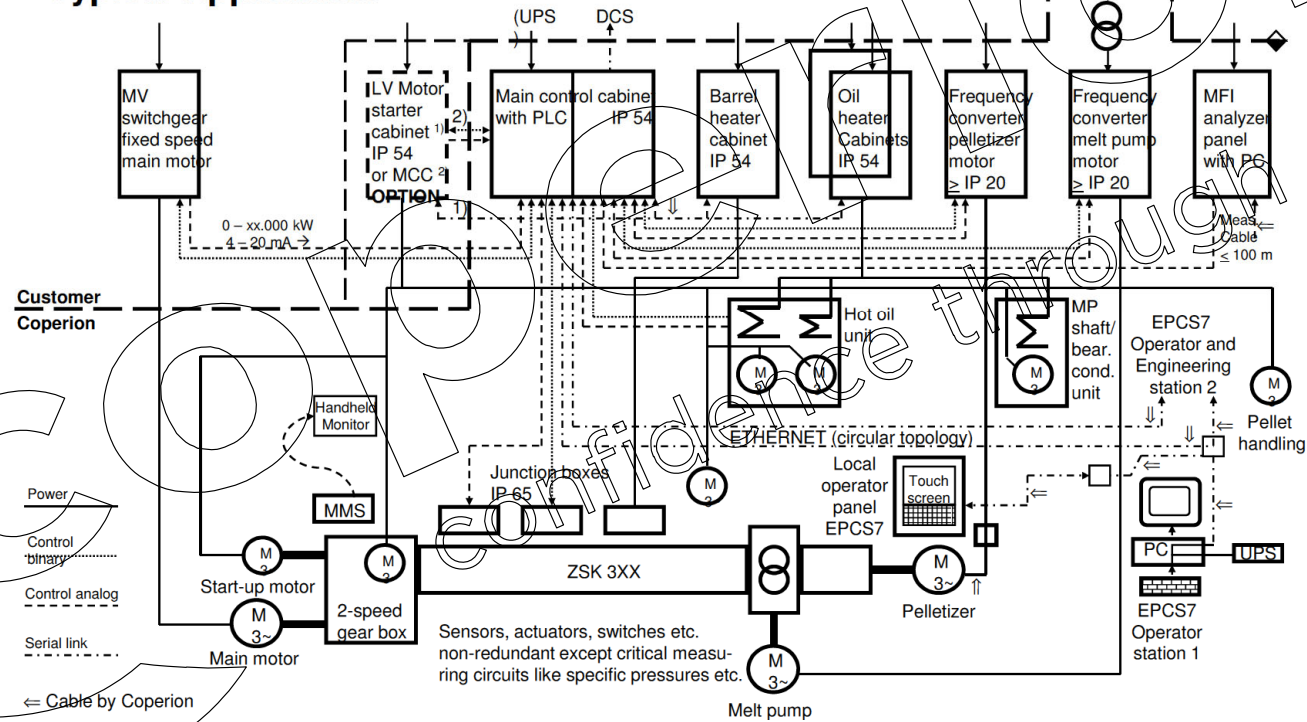
Coperion Software Improvements

Controller System

Keep Functionality and Reliability



Extruder Control System Typical Application



Potential Modification

Controller System

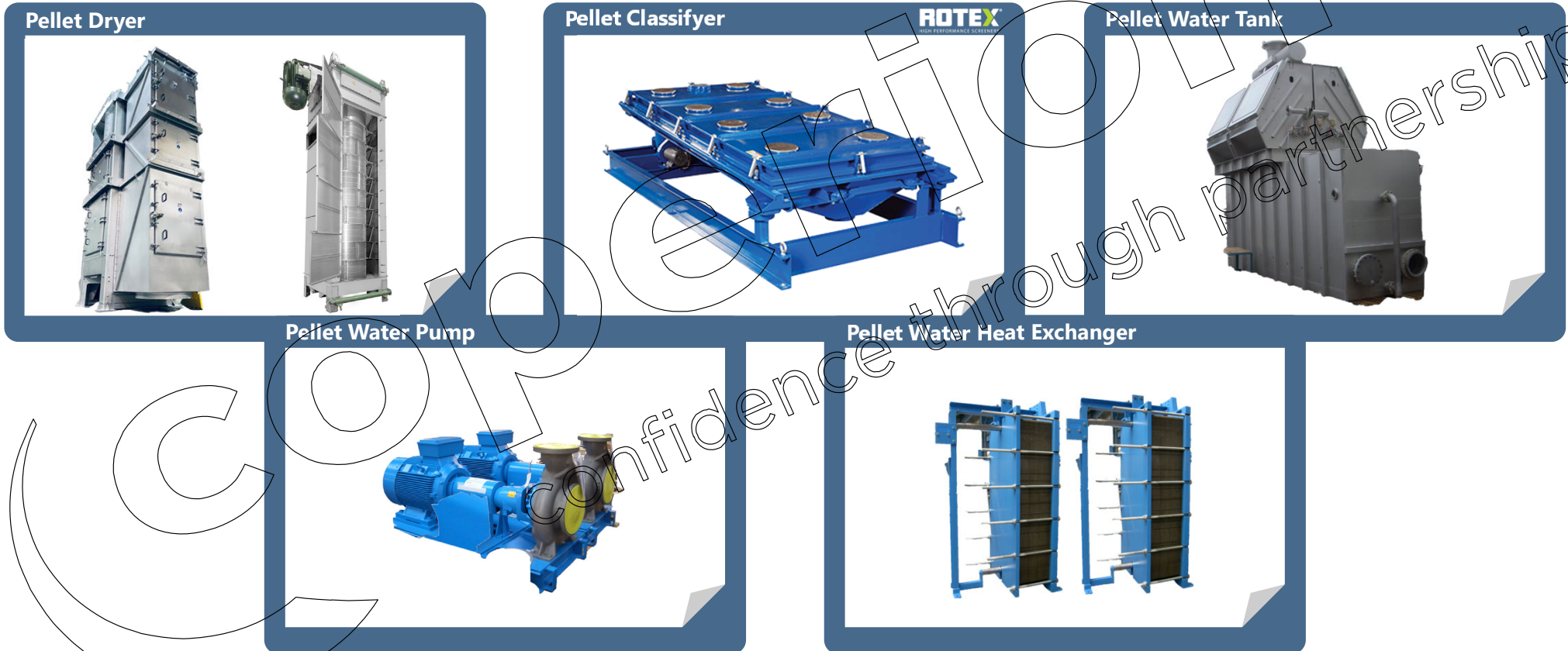
Hardware: Upgrade to latest design to assure spare parts availability and reliability

Hardware: Improve design / layout to increase safety and operational excellence

Software: Upgrade to increase safety and operational excellence

Pellet Treatment System

Dryer, Classifier, Water Tank, Pump, Heat Exchanger





Thank you very much for your attention.

Coperion Technology Update 2025