

A person in a dark suit and tie is holding a tablet computer. The background is dark with a complex digital overlay of white icons, including envelopes, speech bubbles, and network diagrams. The text 'CASE STORIES ARE SUCCESS STORIES' is prominently displayed in white, bold, sans-serif font across the upper half of the image.

CASE STORIES ARE SUCCESS STORIES

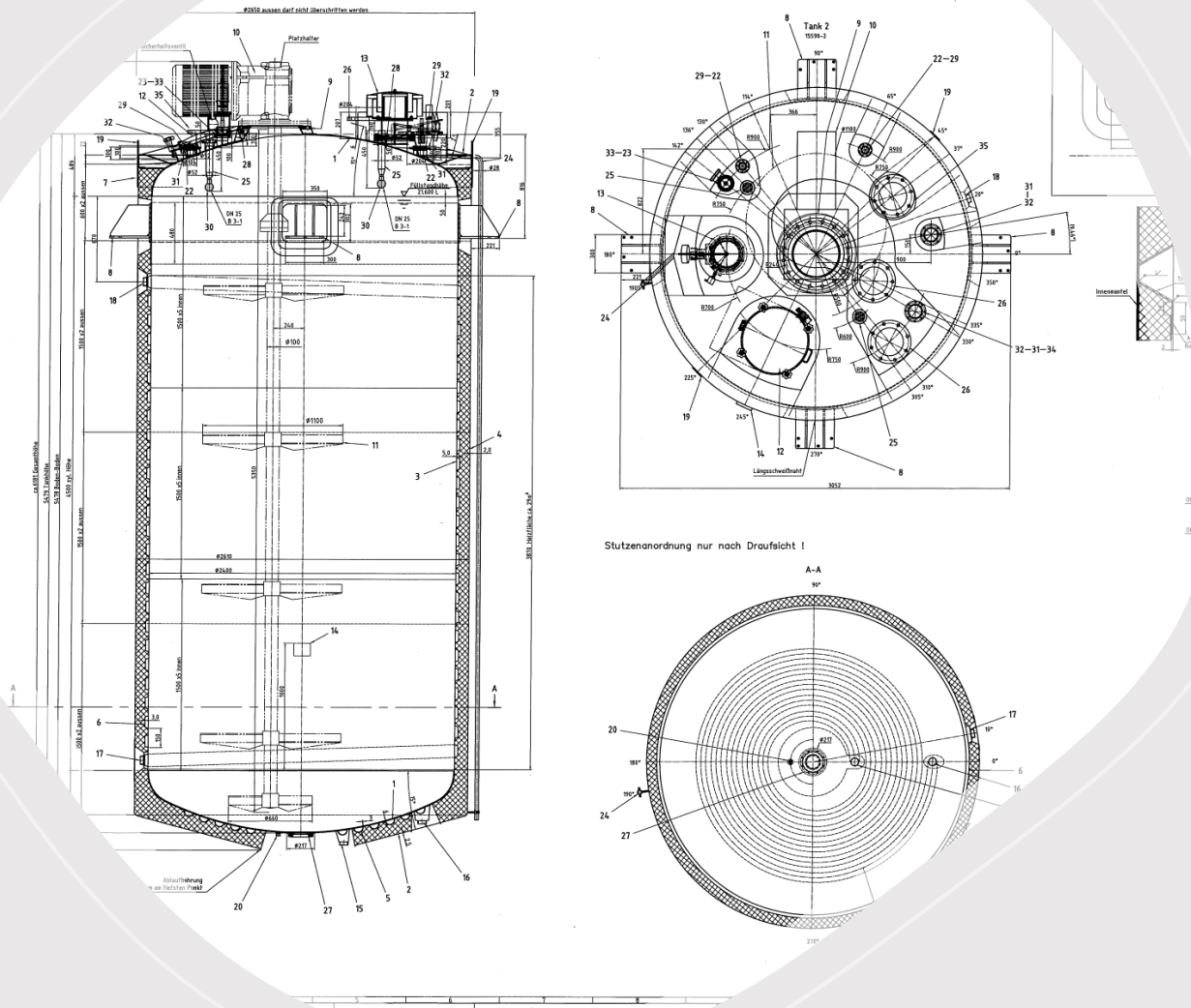
Using case stories is an essential and effective way to generate ongoing & successful business results.

FOOD PRODUCER

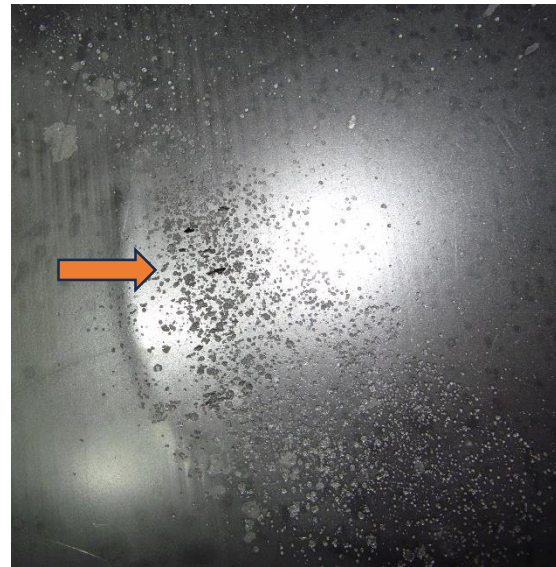
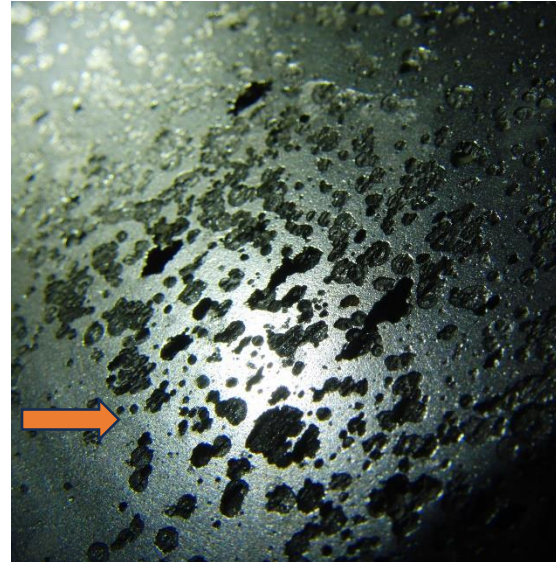
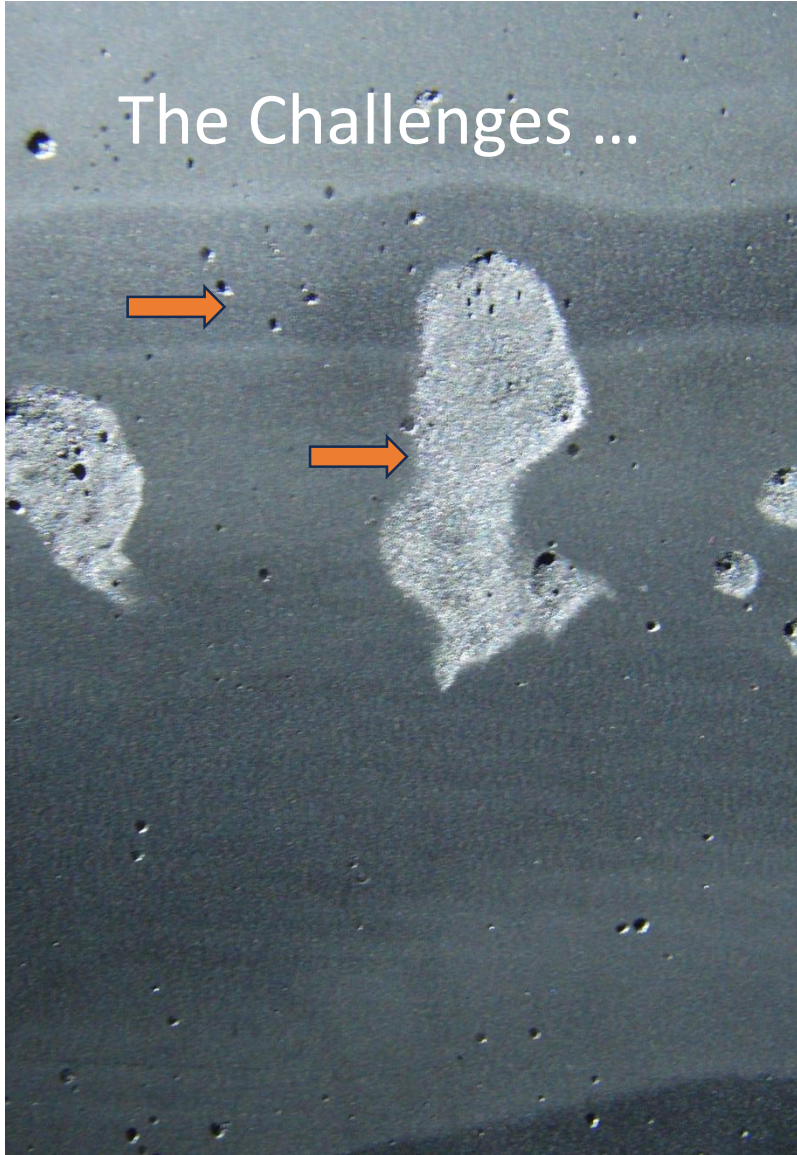
HT-VESSEL IN 1.4404 FAILED
DUE TO HEAVY PITTING
CORROSION – FULL
SUBSTITUTION ON-SITE

Consulting for over 2 years resulted in a reliable Solution & Materials order for this revamping Project

24 m³ Vessel for Food Processing in 316L
heated by half-pipe spiral heat-exchanger (6bar 135°C)
& mixing by high-efficiency Paddle Mixer Duplex
1.4462/2205 type / flights in 316L (1.4404)



The Challenges ...



HT VESSEL 316L (1.4404) Inside Surfaces, including Mixer are affected by Pitting Corrosion

- Cooking Vessel for Food Mixtures Processing
H= 7m D=2.5m s=5mm Wall // Vol =24m³
- Temperature Regimes T = 85°C – 145°C /
pH -Regimes 5 down to 3.5 !
- 1st Vessel in Steel Enamel Coating and Mixer in
rubber-lined Construction (2010-2015)
- 2nd Vessel in 316L (1.4404) operated
from 2016-2020
- Heavy Pitting & Crevice Corrosion after
3 years operation only
- Dished Boiler Head close to leakage (!)
- Problem 1 = Vessel Stability / potential Interruption
of Production
- Problem 2 = Food contamination (!)
- Problem 3 = CIP Cleaning is no longer possible
due to GMP Rules
- 1:1 Substitution on-site and in restricted time-
slots of 14days

Materials selection and qualification process – the real Problems

- (1) Vessel in Operation: No cut-out Sections for damage Investigations available
- (2) Customers Assumptions: The problem can/must be solved without Lab-Tests or Field Tests, although time was sufficient – more than 2 Years
- (3) Desperate Need to find Equivalence Cases through DataMining & Publication Research (TEC LAB Report- 1 Table & Pictures...)
- (4) 1st Orientation according to Pitting & Crevice Design Criteria
- (5) Change the frame Conditions to avoid Crevice Corrosion &
- (6) Change the Cleaning Intervals to higher frequent Cycles and apply Passivation Agents to recover protected Surfaces

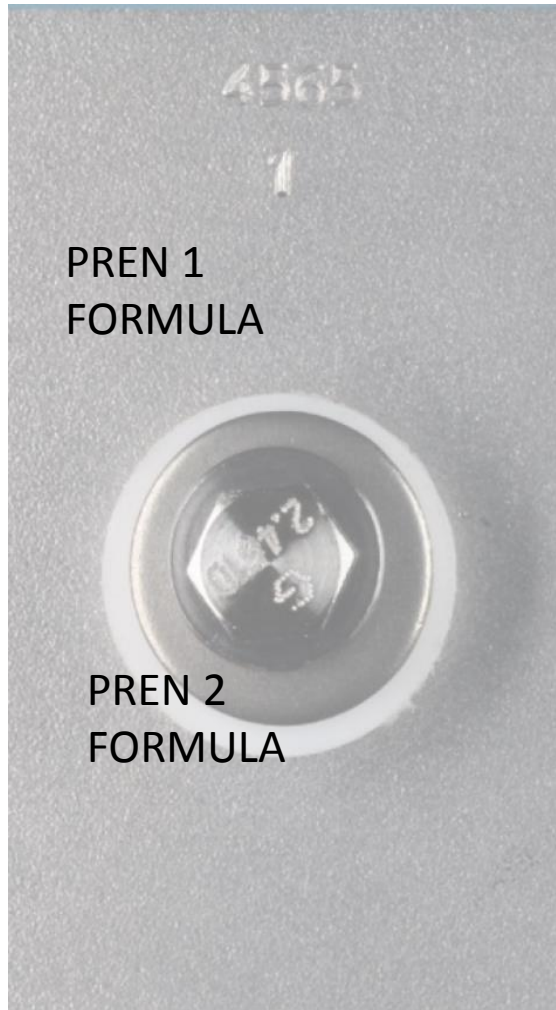
The selection and qualification of materials for problem-solving is imperative. It is essential to ensure that the right materials are chosen for the task at hand. Any mistakes in material selection can lead to significant setbacks and even failure. Therefore, it is crucial to approach this process with the utmost care and attention to detail. Without the proper materials, there can be no solution.

Vessel 2 – Real
Media
Compositions
& Temperature
Loads

Mixture 1	Mass	Unit
Water	6900	Kg
Sodiumchloride (liq)	1350	Kg
Hydroxypropionic Acid (liq)	2000	Kg
Potassiumhydroxyde (liq)	2000	Kg
Yeast (liq)	10000	Kg
Producttemp. 90 °C, Temp. Vesselwall (in) 135°C, pH-Value 5,3		

Mixture 4	Mass	Unit	
Water	15000	Kg	
Sodiumchloride	4000	Kg	★
Hydroxypropionic Acid (liq)	220	Kg	★
Citric Acid	50	Kg	★
Yeast (liq)	1900	Kg	★
Producttemp. 80 °C, Temp. Vessel Wall (in) 135°C, pH- Value 3,9 -4,3 ★			

Design for Corrosion Resistance; Pitting Resistance Equivalent Number (PREN)

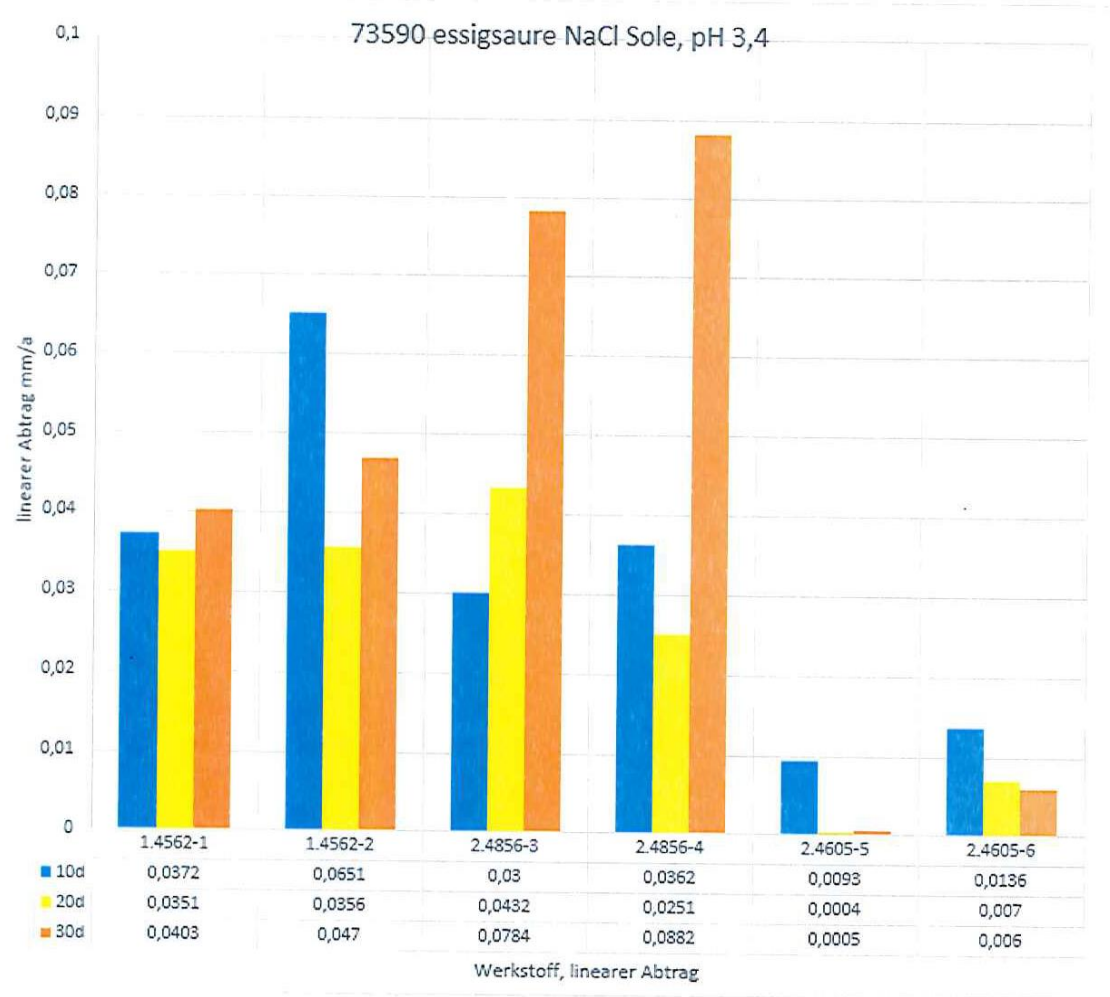


$$\text{PREN1} = \% \text{ Chromium} + \% 3,3 \times \text{Molybdenum} + 30 \times \% \text{ Nitrogen}$$

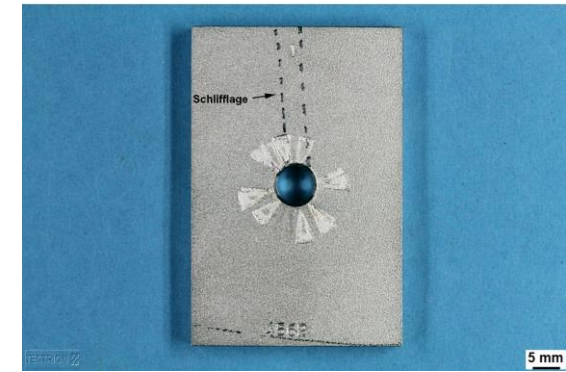
$$\text{PREN2} = \% \text{ Chromium} + \% 3,3 \times \text{Molybdenum} + 16 \times \% \text{ Nitrogen}$$

PREN 1 & 2 permit a first orientation and ranking against Pitting Corrosion and Crevice Corrosion

TEC Lab (Equivalence Comparison to Damage Case)
 Test - > 30days / pH 5.6 to 3.4 / T > 103°C sub boiling



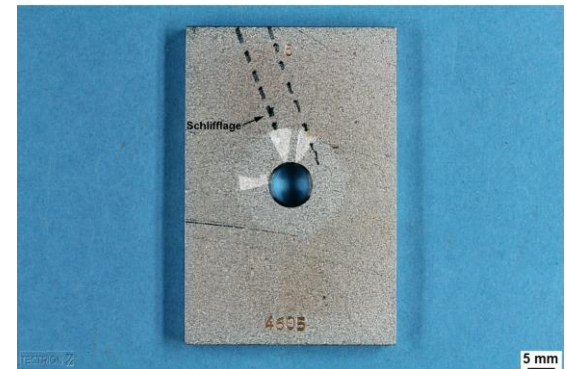
ALLOY 31



ALLOY 625



ALLOY 59



Vessel 2 & Mixer - Alloy Design as of 2015

		Ni	Cr	Fe	Mo	Mn	Ti	N2	P	S	C	PREN 1
A316	1.4571	12	18	R	2.5	2.0	.7 Ti		.015	.005	.08	26
A316L	1.4404	12	17	R	2.2	2.0		.10	.045	.03	.03	27
A2205	1.4462	5	22	R	3	2.0		.02	.015	.005	.03	33

Chemical Composition [mass%] Simplified Averages

Alloy 316 & Alloy 316L for vertical Walls & Components & Spiral Heat Exchanger ; Alloy 2205 for Center Rod of 5m Mixer

Vessel & Mixer – New Alloy Design as of 2021/2022

	Ni	Cr	Fe	Mo	Mn	Si	Nb	N2	P	S	C	Cu Co	PREN
A24	18	24	R	4	5		.15	.45	.015	.005	.030		1
A31	31	27	R	6.5	2.0	.30		.02	.020	.010	.015	1.4	53
A59	R	23	1.5	16	.5	.10			.015	.005	.010	.03	>70

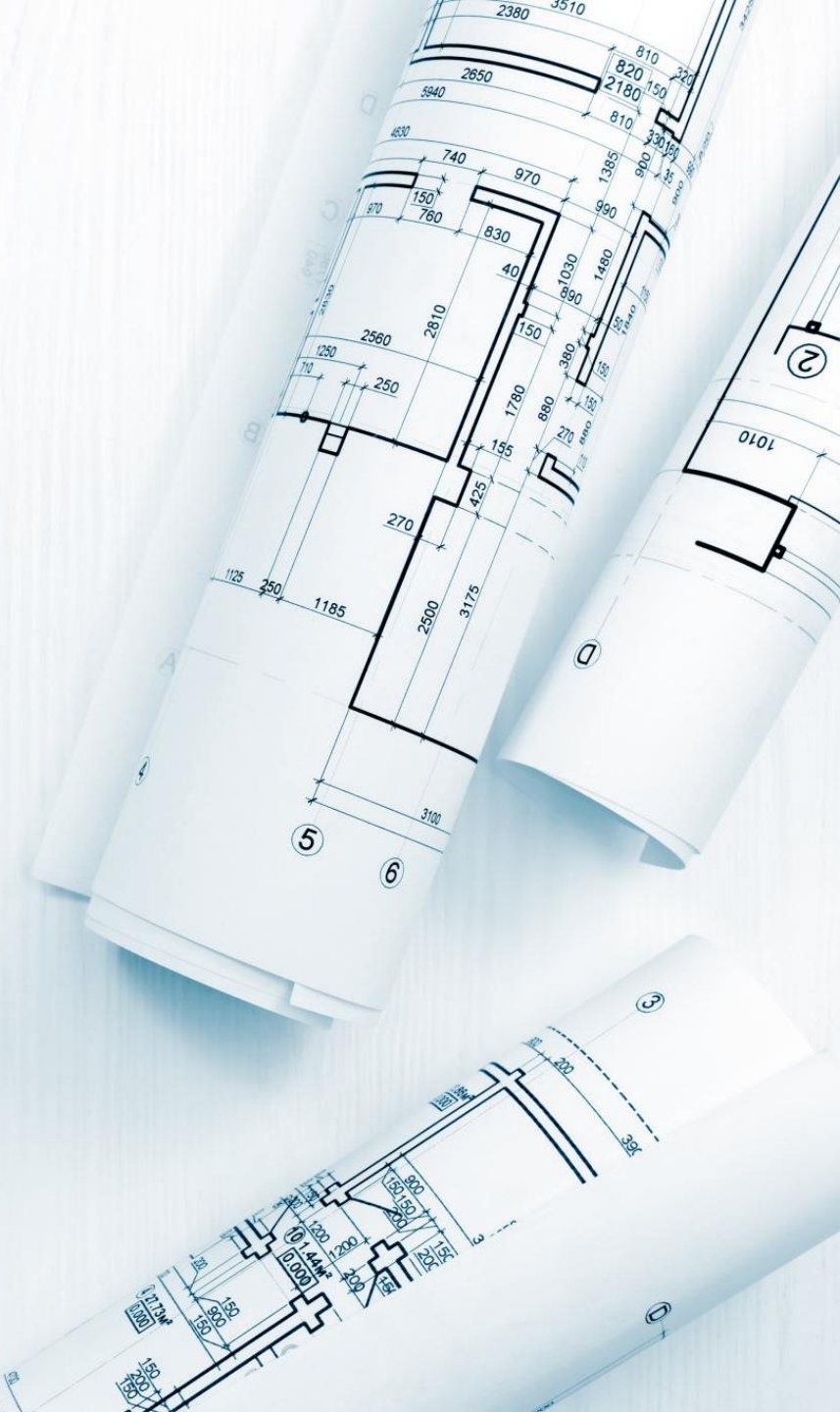
Chemical Composition [mass%] Simplified Averages

Potential alternative Alloy Design for new Construction by experienced Fabricators only

Alloy 24 or Alloy 31 for vertical Walls ;Alloy 59 for dished Bottom & Cap

A potential Solution was proposed,
accepted and ordered in March
2022

- extremely exposed dished
bottom in **ALLOY 59**
- all vertical inside Walls
in **ALLOY 31/24**
- high-frequency **CIP Cleaning**
with a modified Passivation
Procedure





Artificial Intelligence / Data Mining
& Picture using AI Tools

CASE STORIES TURN INTO SUCCESS STORIES

Ingredients & Prerequisites

- Collaboration across Company Borders
- Teamwork
- Data Mining using Human & Artificial-Intelligence
- Consulting & Coaching

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