

TERIEL
GOSTYŃ

WE CAST THE FUTURE



PRESENTATION CONTENTS

1. INTRODUCTION OF TERIEL SP. Z O.O.

-- WHO ARE WE AND WHAT WE DO?

2. QUALITY MANAGEMENT SYSTEM, A SHORT PRESENTATION

-- HOW DO WE ACHIEVE OUR GOALS AND DELIVER WHAT THE CUSTOMER NEEDS?

3. HARD, BUT DURABLE

-- REASONS TO USE HIGH SILICON CAST IRON MATERIALS

4. RAILWAY CASTINGS

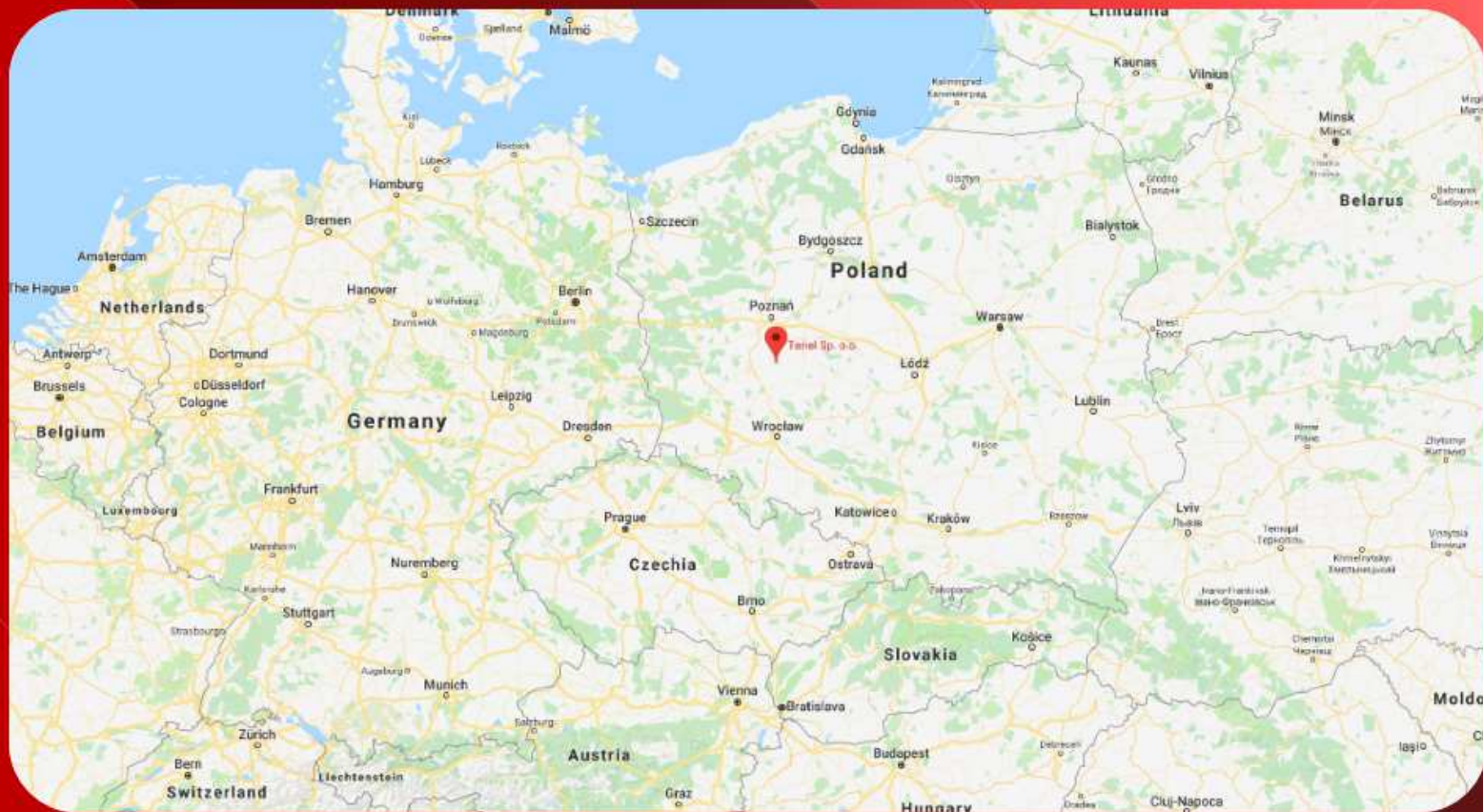
-- RUNNING PROJECTS & FUTURE PROJECTS





INTRODUCTION OF TERIEL SP. Z O.O.

WHO ARE WE AND WHAT WE DO?



PLACED IN CENTRAL EUROPE IS AN EXCELLENT PLACEMENT FOR EASY AND QUICK SUPPLY OF CASTINGS FOR MOST COUNTRIES IN EUROPE.

COMPANY PROFILE

NAME: TERIEL SP. Z O.O.

ADDRESS: UL.LIPOWA 2A, 63-800 GOSTYŃ

CONTACT: Tel. 0048 65 572 08 20,
Fax 0048 65 572 14 05,
E-mail: gostyn@teriel.com.pl,
www.teriel.pl

ESTABLISHED: 1953 (OWNED BY GMT SINCE 2004)

SPACE: 40 000 m²

WORKFORCE: 130 persons

YEARLY TURNOVER: 61 mln. PLN

PRODUCTION CAPACITY: 10 000 tons per year



1

QUALITY

2

COMMUNICATION

3

INNOVATION

4

TIMELY DELIVERIES



The background of the slide is a dark, industrial scene, possibly a foundry or casting plant, with various pieces of machinery and a worker visible. The scene is overlaid with a red geometric pattern consisting of large, overlapping circles and triangles. Three white circular callouts with red borders are positioned over the image, each containing text. The top-left callout is titled 'TECHNOLOGY' and describes the moulding process. The bottom-center callout is titled 'FLEXIBILITY' and provides details on casting weights and batch sizes. The right-side callout is titled 'MAIN MARKETS' and lists various industries served by the technology.

TECHNOLOGY

HORIZONTAL MOULDING LINE WITH
GREEN SAND MOULDING

FLEXIBILITY

CASTINGS WEIGHT RANGING
FROM 0,2 KG TO 150 KG

BATCH SIZES
FROM 5 TO 6000 PCS.

MAIN MARKETS

- RAILWAY MARKET (SAFETY PARTS),
- OIL, GAS AND INDUSTRIAL VALVES,
- MECHANICAL ENGINEERING,
- ELEVATORS,
- ESCALATORS,
- GEARS AND BOXES,
- WATER AND GAS FITTINGS,
- AGRICULTURAL MACHINERY,
- CHASIS PARTS – REPLACED THE STEEL CONSTRUCTION



PRODUCTION

PATTERN SHOP:

- PATTERNS AND CORE BOXES MADE OF WOOD, RESIN AND/OR METAL

MELTING:

- 2 INDUCTION FURNACES OF MEDIUM FREQUENCY – 1 x 4 TONS & 1 x 3 TONS (BY JUNKER),
- HOLDING FURNACE 10 - TONS

MOULDING:

- AUTOMATIC MOULDING LINE HANSBERG 750x750x220/220,
- JOLT-SQUEEZE MOULDING MACHINES: FKT 1000x800x350/350,
- SAVELLI SAND PLANT

CORE SHOP:

- „COLD BOX” CORE PRODUCTION METHOD (USING ROEPER-WERK H2,5; H5; H12)
- CO₂-MANUAL CORE PRODUCTION METHOD,
- „HOT BOX” CORE PRODUCTION METHOD

FETTLING AND FINISHING:

- TURBINE AND CHAIN SHOT BLASTING BY STEM



TESTING EQUIPMENT

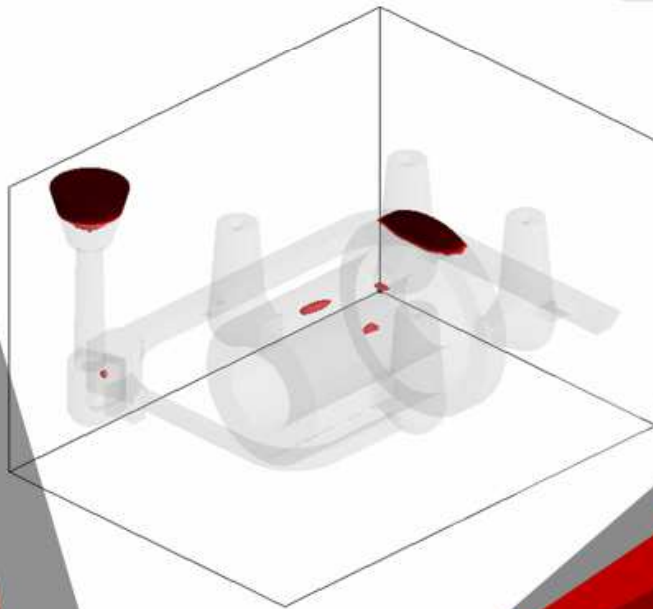
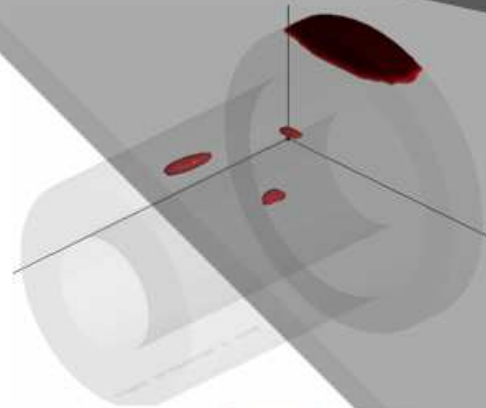
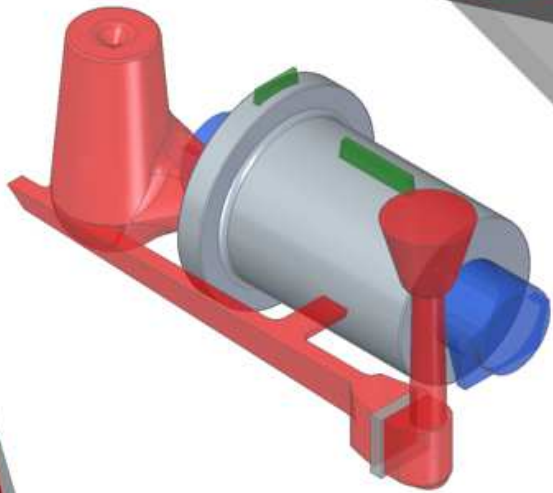
- UNIVERSAL TESTING MACHINE– ZWICK Z100 PROLINE
- CHARPY HAMMER– ZWICK RKP 450 GE
- HARDNESS TESTING- BRINELL ZWICK
- SPEKTROMETER – SPECTROLAB M11
- LECO C-S-TESTER
- FACILITIES FOR MOULDING SAND TESTING
- FARO 3-D MEASUREMENT
- COATING THICKNESS GAUGE
- ECHOMETER KARL DEUTSCH 1077 – ULTRASONIC TESTING
POSSIBILITY OF DETECTING MATERIAL DISCONTINUITIES IN CASTINGS
UP TO 0,1 MM
- BNIF/SCRATA SURFACE COMPARATORS
- SURFACE ROUGHNESS COMPARATORS [Ra]
- ITACA THERMAL ANALYSIS SYSTEM

COMPUTER SYSTEMS

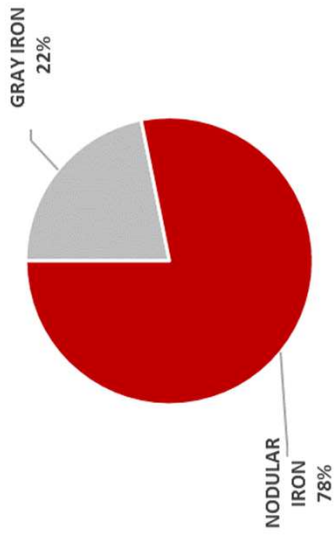
COMPUTER SYSTEM TO SUPPORT SALES AND MARKETING BUT ALSO PRODUCTION PLANNING AND CONTROL - FERRODO

CAD: SOLID EDGE ST9

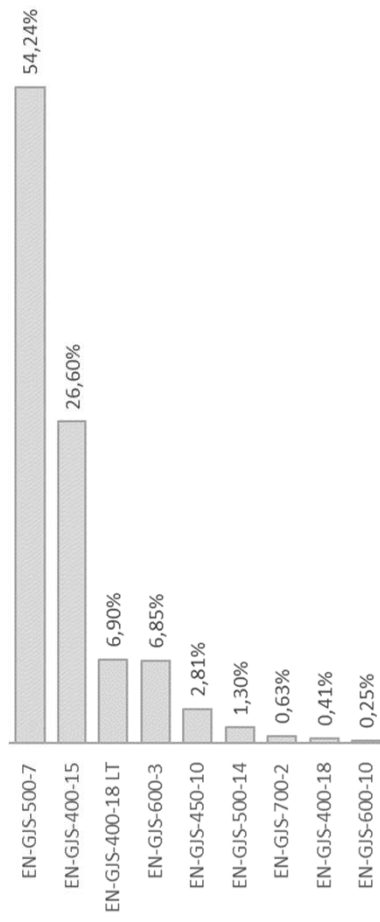
SOLIDIFICATION SIMULATION: NOVAFLOW & SOLID



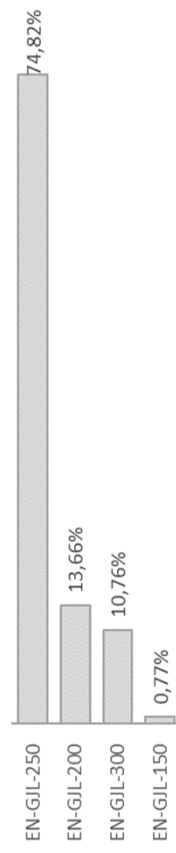
PRODUCTION BY CAST IRON TYPE



NODULAR IRON PRODUCTION



GRAY CAST IRON PRODUCTION



*ISO 9001:2015
CERTIFIED*



*ISO 14001:2015
CERTIFIED*



OTHER CERTIFICATES

QUALITY ASSURANCE SYSTEM IN ACCORDANCE WITH THE PRESSURE DIRECTIVE 2014/68/EU, ANEX 1, SECTION 4.3 AND AD 2000-MERKBLATT W 0 AS WELL AS EN 764-5, PARA 4.2 CERTIFICATE.

LLOYDS REGISTER AND DNV GL FOR OIL / GAS AND MARITIME SOLUTIONS CERTIFICATE





CASTING EXAMPLES



The background features a collage of various quality management diagrams and documents. On the left, there are several sheets of paper with handwritten notes and flowcharts. One prominent diagram shows a circular process with 'PLAN', 'DO', and 'CHECK' stages, with 'LEADERSHIP' at the center. Another diagram shows a hierarchical structure with boxes and arrows. The overall theme is quality management and process improvement.

QUALITY MANAGEMENT SYSTEM, A SHORT PRESENTATION
HOW DO WE ACHIEVE OUR GOALS AND DELIVER WHAT THE CUSTOMER NEEDS?

QUALITY MANAGEMENT SYSTEM

IT IS A SYSTEM FOR DOCUMENTING THE STRUCTURE, PROCEDURES, RESPONSIBILITIES AND PROCESSES NEEDED FOR EFFECTIVE QUALITY MANAGEMENT

IT OUTLINES HOW AN ORGANIZATION WILL PRODUCE, DOCUMENT, CONTROL AND DELIVER A PRODUCT OR SERVICE IN REGARDS TO CUSTOMER NEEDS

So how does
TERIEL's QMS
look like?





**ONE MAIN PROCESS
„LEADERSHIP”**

IT IS THE MAIN PROCESS
RESPONSIBLE FOR DECISION MAKING AND
SETTING STRATEGIC GOALS WHICH ARE
INPUTS FOR FURTHER PROCESSES

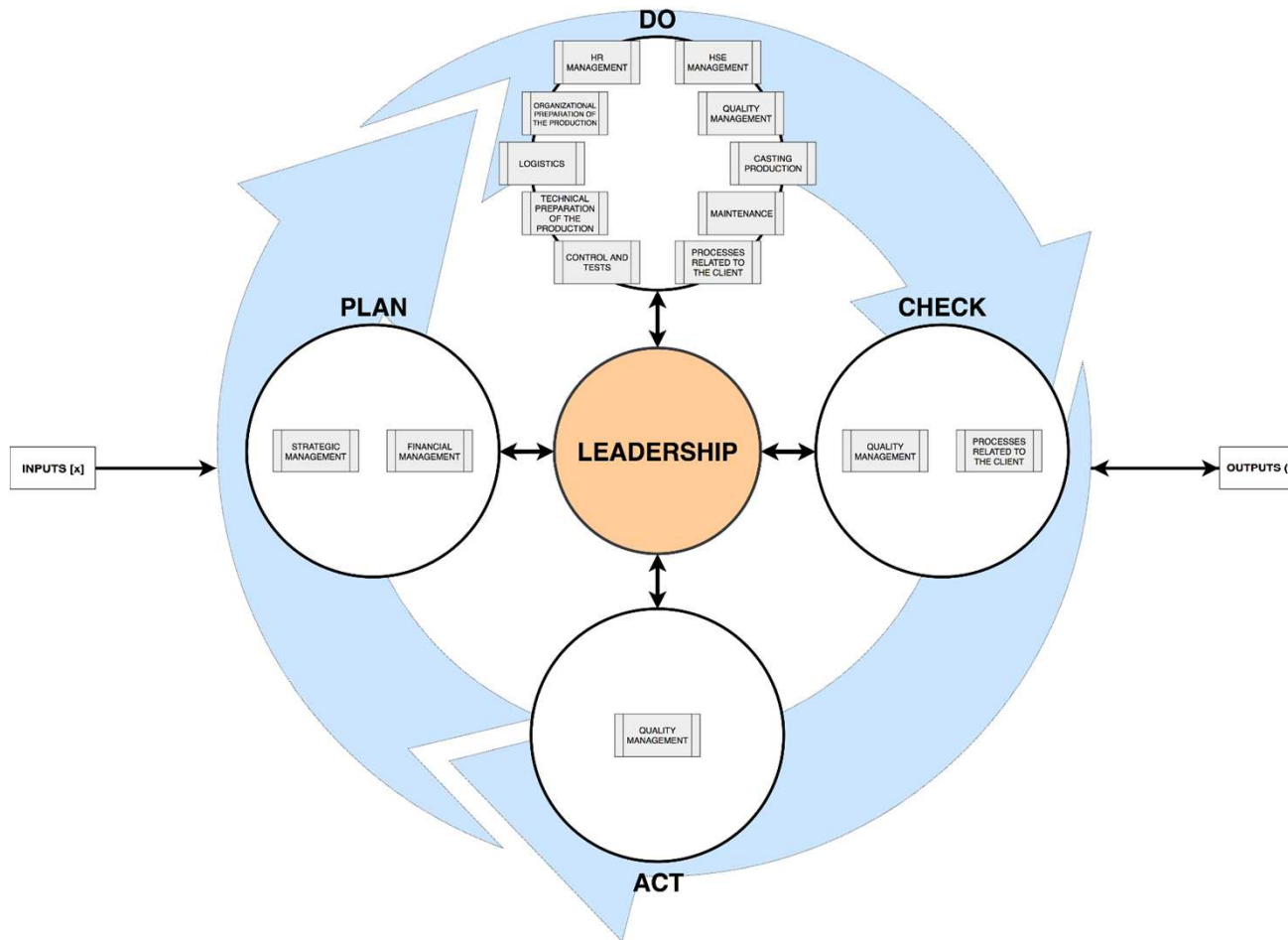
**FOUR GROUPS
OF PROCESSES**

„PLAN”
„DO”,
„CHECK”
„ACT”

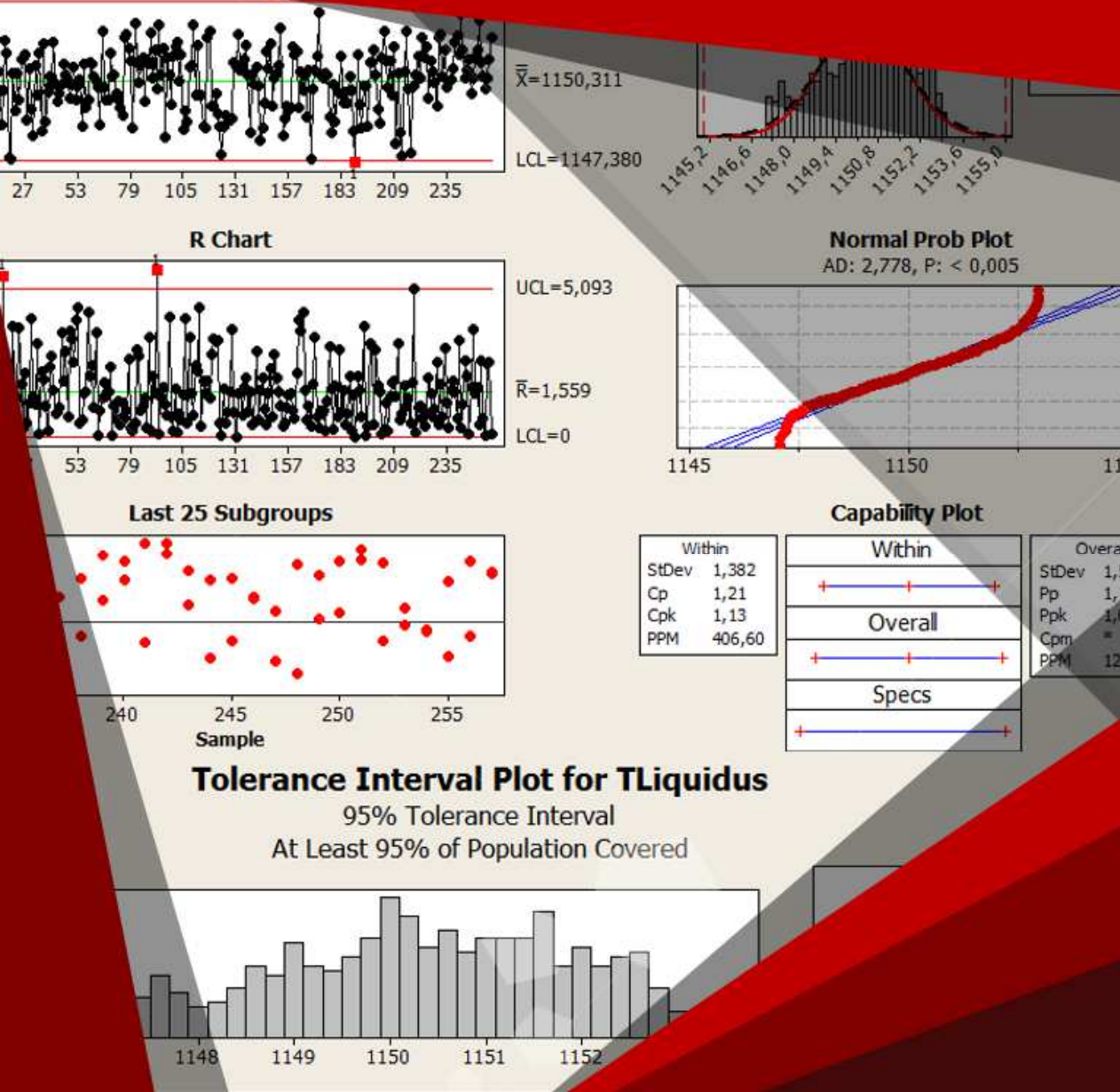
**EACH GROUP HAS
SUBPROCESSES**

- „PLAN” – PROCESSES RELATED TO PLANNING
(HOW TO ACHIEVE THE SET GOALS)
- „DO” – PROCESSES RELATED TO EXECUTION OF THE PLANS
- „CHECK” – PROCESSES RELATED TO THE EVALUATION OF
THE MANAGEMENT SYSTEM EFFECTIVNESS
- „ACT” – PROCESSES RELATED TO IMPROVEMENT OF THE
MANAGEMENT SYSTEM

MANAGEMENT SYSTEM VISUALIZATION



METHODS AND TOOLS USED



FMEA ACC. TO AIAG

CONTROL PLAN ACC. TO AIAG

SPC (SHEWART'S CONTROL CHARTS, CP, CPK, PP, PPK)

MEASUREMENT SYSTEM ANALYSIS (MSA)

FLOW CHARTS

5WHY

5W+2H

ISHIKAWA DIAGRAMS

PARETO ANALYSIS

CORRELATION & REGRESSION ANALYSIS

APQP ACC. TO AIAG (*IMPLEMENTATION STAGE*)

PPAP ACC. TO AIAG (*IMPLEMENTATION STAGE*)

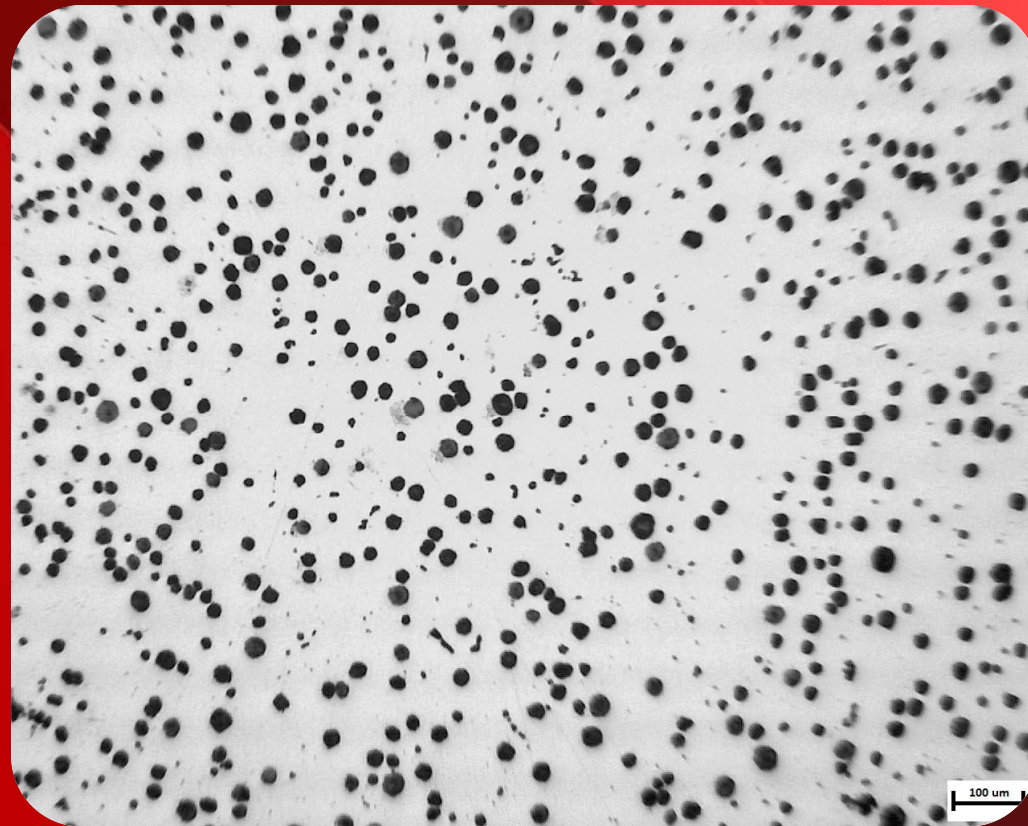
DOE (DESIGN OF EXPERIMENTS)

SIX SIGMA INDICES & METHODS (*IMPLEMENTATION STAGE*)



HARD, BUT DURABLE

REASONS TO USE HIGH SILICON CAST IRON MATERIALS



DUCTILE IRON (EN-GJS EARLIER GGG) HAS BEEN KNOWN FOR 60 YEARS AND HAS BEEN PRODUCED INDUSTRIALLY IN EUROPE SINCE THE 1950S.

CONVENTIONAL DUCTILE CAST IRON

THE TECHNOLOGICAL PROPERTIES OF THE CONVENTIONAL FERRITIC-PERLITIC CAST IRON GRADES WITH NODULAR GRAPHITE (GJS) NORMALIZED IN DIN-EN 1563 ARE REGULATED BY THE RATIO OF FERRITE TO PEARLITE BY THE INTENTIONAL ADDITION OF PERLITE-FORMING ADDITIVES (MN, CU, SN).

THE PROBLEM OF TRADITIONAL VARIETIES IS DESCRIBED BY THE PROPORTION OF HARD, BUT FRAGILE PERLITES: "THE STRONGER THE MORE FRAGILE"

WITH TRADITIONAL GRADES, THE COOLING RATE HAS A VERY LARGE EFFECT ON MECHANICAL PROPERTIES. PARTICULARLY IN THE CASE OF ELEMENTS WITH VARYING WALL THICKNESSES, THE INSIDE OF THE CASTING REACHES A DISTINCT DIFFERENCE IN STRENGTH AND HARDNESS.





ALTERNATIVE DUCTILE IRON GRADES

BY INCREASING THE SILICON CONTENT, IT IS NOW POSSIBLE TO REDUCE THE AMOUNT OF PERLITE FORMING ELEMENTS AND PRODUCE MATERIALS WITH SIGNIFICANTLY HIGHER MECHANICAL PROPERTIES.

THIS COMBINATION OF PROPERTIES IS OBTAINED THROUGH A UNIFORM FERRITE STRUCTURE REINFORCED WITH SILICON.

THE MORE SILICON PRECIPITATES IN THE FERRITE, THE MORE THE STRENGTH INCREASES - HOWEVER, THE ELONGATION AT BREAK DOES NOT INCREASE AS IT HAPPENS WITH CONVENTIONAL SPECIES.

THE CONDITION FOR OBTAINING THE MAXIMUM MECHANICAL PROPERTIES ARE OPTIMAL SHAPES OF THE GRAPHITE NODULES, WHICH CAN BE ACHIEVED BY MEANS OF SPECIAL METAL INOCULATION TECHNOLOGIES, WHICH ARE DETERMINED BY THE APPROPRIATE SILICON CONTENT AND THE MAXIMUM COOLING TIME.

NEW CAST IRON GRADES HAVE:

- HIGHER YIELD POINT
- HIGHER ELONGATION
- VERY HIGH DUCTILITY VALUES
- HIGH K1C FRACTURE TOUGHNESS PARAMETERS
- RESISTANCE TO INTERNAL PRESSURE UP TO 900 BAR
- THE DENSITY OF THE NEW DUCTILE IRON GRADES IS 8% LOWER THAN THAT OF STEEL.





BENEFITS FOR THE CUSTOMER

THE COMBINATION OF THESE PROPERTIES OPENS THE CUSTOMER WITH FOUR OPTIMIZATION FIELDS:

● THE CONSTRUCTION OPENS THE POTENTIAL FOR LIGHT CONSTRUCTION

● LOWERING PRODUCTION COSTS BY AVOIDING WELDING COSTS

● REDUCE STIFFNESS AND INCREASE THE DURABILITY OF THE CONSTRUCTION

● USING EXISTING CASTINGS FOR HIGHER LOADS WITHOUT GEOMETRIC CHANGES

● LOW COST MACHINING THROUGH FASTER CUTTING SPEED AND LESS TOOL WEAR

ISO 1563:2018

		SEPARATELY CAST SAMPLE			SAMPLE CUT FROM CASTING		
Material	Wall thickness t in mm	Rp02 MPA Min	Rm MPA Min	A%	Rp02 MPA Min	Rm MPA Min	A%
EN-GJS-500-7	t ≤ 30	320	500	7	300	480	6
	30 < t ≤ 60	300	450	7	280	450	5
	60 < t ≤ 200	290	420	5	260	400	3
EN-GJS-500-14	t ≤ 30	400	500	14	400	480	12
	30 < t ≤ 60	390	480	12	390	460	10
	60 < t ≤ 200	Do ustalenia					
EN-GJS-600-3	t ≤ 30	370	600	3	360	580	3
	30 < t ≤ 60	360	600	2	340	550	2
	60 < t ≤ 200	340	550	1	320	500	1
EN-GJS600-10	t ≤ 30	470	600	10	450	580	8
	30 < t ≤ 60	450	580	8	430	560	6
	60 < t ≤ 200	Do ustalenia					

Material designation		Brinell hardness range HBW	
Symbol	Number	Relevant wall thickness t	
		t ≤ 60 mm	60 mm < t ≤ 200 mm
EN-GJS-350-22	5.3102	< 160	< 160
EN-GJS-400-18	5.3105	130 to 175 ^a	130 to 175 ^a
EN-GJS-400-15	5.3106	135 to 180 ^a	135 to 180 ^a
EN-GJS-450-18	5.3108	170 to 200	160 to 190
EN-GJS-450-10	5.3107	160 to 210 ^a	160 to 210 ^a
EN-GJS-500-14	5.3109	185 to 215	170 to 200
EN-GJS-500-7	5.3200	170 to 230 ^a	150 to 230 ^a
EN-GJS-600-10	5.3110	200 to 230	190 to 220
EN-GJS-600-3	5.3201	190 to 270 ^a	180 to 270 ^a
EN-GJS-700-2	5.3300	225 to 305 ^a	210 to 305 ^a
EN-GJS-800-2	5.3301	245 to 335 ^a	240 to 335 ^a
EN-GJS-900-2	5.3302	270 to 360 ^a	270 to 360 ^a

NOTE 1 The lowest hardness is achieved with a ferritic matrix and low silicon content. The hardness increases with the amount of pearlite or increased silicon content.

NOTE 2 Eutectic carbides increase hardness but they are normally undesirable and only likely to be present in minor amounts.

^a By agreement between the manufacturer and the purchaser, a narrower hardness range may be adopted; a tolerance range of between 30 and 40 Brinell hardness units is commonly acceptable. This hardness range may be wider for grades with a ferritic-pearlitic matrix microstructure.

COMPARISON OF THE MECHANICAL PROPERTIES

MACHINING OPTIMALIZATION

AN IMPORTANT ADVANTAGE OF SILICON STRENGTHENED IRON GRADES IS THAT COMPARED TO FERRITIC / PEARLITIC GRADES OF EN-GJS MATERIAL, THEY CAN BE TREATED WITH THE SAME LOWER STRENGTHS, DUE TO LESS ABRASIVENESS OF THE TOOLS, AND COST LESS.

THE TOOL LIFE PERIOD FOR FERRITIC MATERIAL GRADES EN-GJS-600-10 AND 500-14 IS LONGER BY ABOUT 50 TO 60% COMPARED TO CONVENTIONAL FERRITIC / PERLITIC MATERIALS!

IT CAN BE DEDUCED THAT FOR MACHINING OPERATOR OF MIXED FERRITIC GRADES THAT AT THE SAME CUTTING SPEEDS, THE INTERVALS BETWEEN CHANGES OF THE TOOLS ARE LONGER COMPARED TO THE MACHINING OF REGULAR FERRITIC / PERLITIC MATERIALS, AND THEREFORE THE USE OF THE MACHINE IS IMPROVED.



SUMMARY

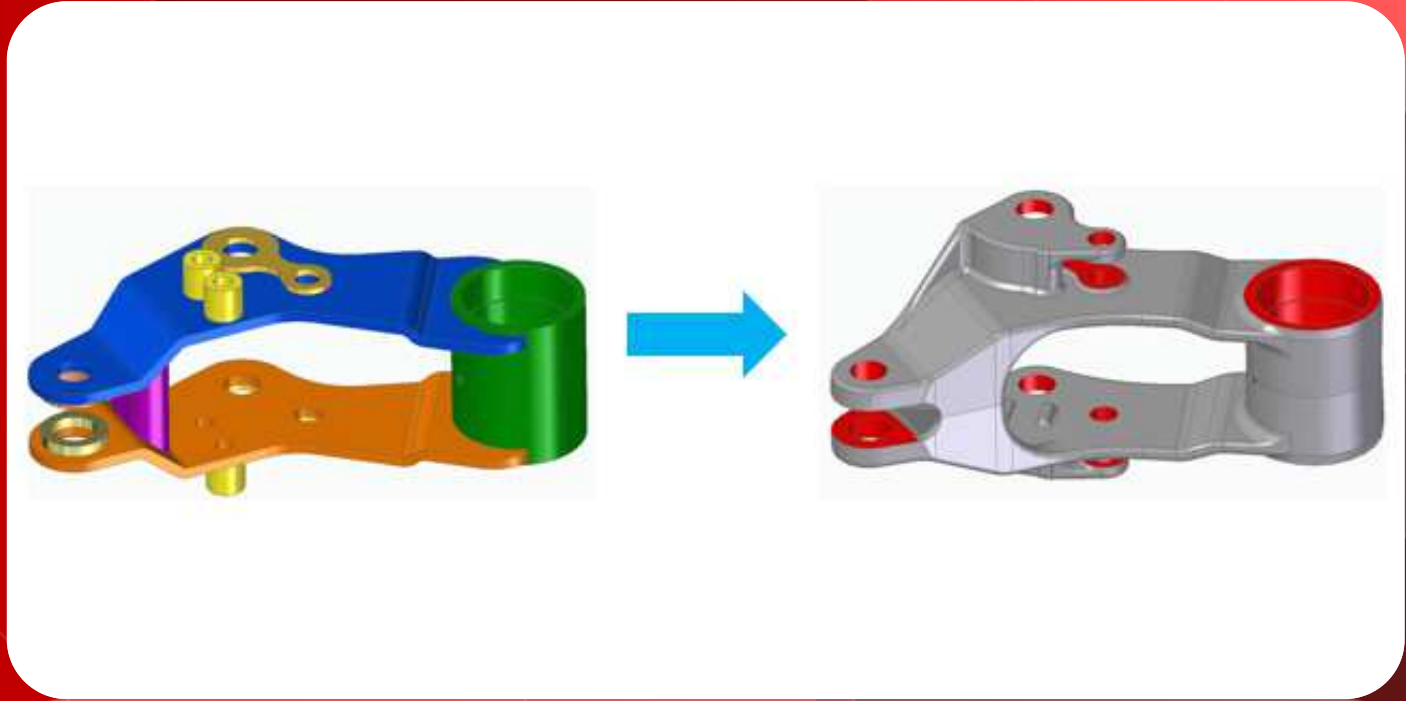
MATERIALS STRENGTHENED WITH SILICON GIVE THE FOLLOWING OPTIONS:

- HIGH STRENGTH WITH COMPARABLE GOOD ELONGATION
- EVEN DISTRIBUTION OF HARDNESS AND STRENGTH
- BETTER MACHINABILITY WITH LESS TOOL WEAR
- OPTIMIZATION TO A SMALLER WALL THICKNESS (LIGHT CONSTRUCTION) OR HIGHER CASTING LOAD WITHOUT GEOMETRIC CHANGES
- EXISTING MODELS AND GATING SYSTEMS CAN BE POURED WITHOUT MAKING CHANGES

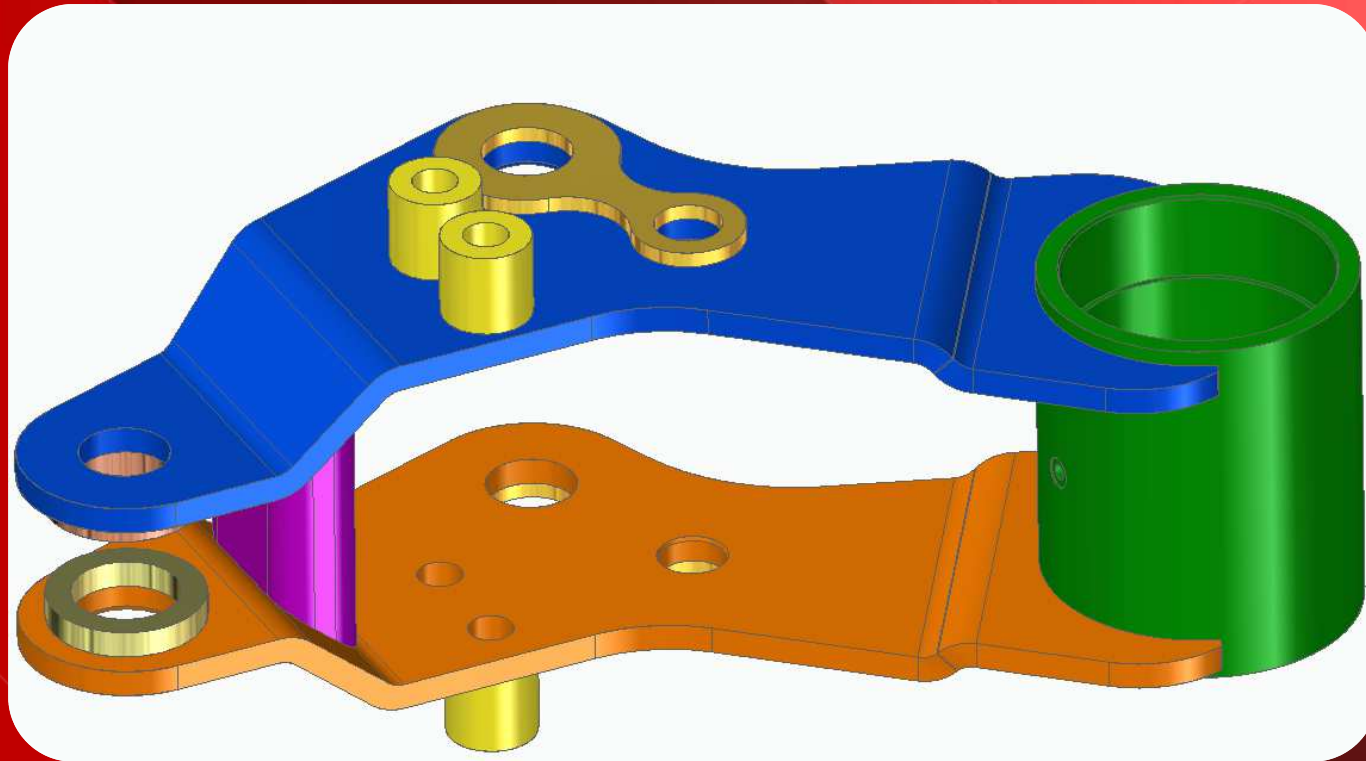
THESE MATERIALS FILL THE GAP BETWEEN „NORMAL“ DUCTILE CAST IRON AND STEEL.

QUELLE : GIESSEREI 7 UND 8 / 2013 AUTOREN DR.-ING. H. LÖBLICH UND DR.-ING. W. STETS, INSTITUT FÜR GIESSEREITECHNIK DÜSSELDORF

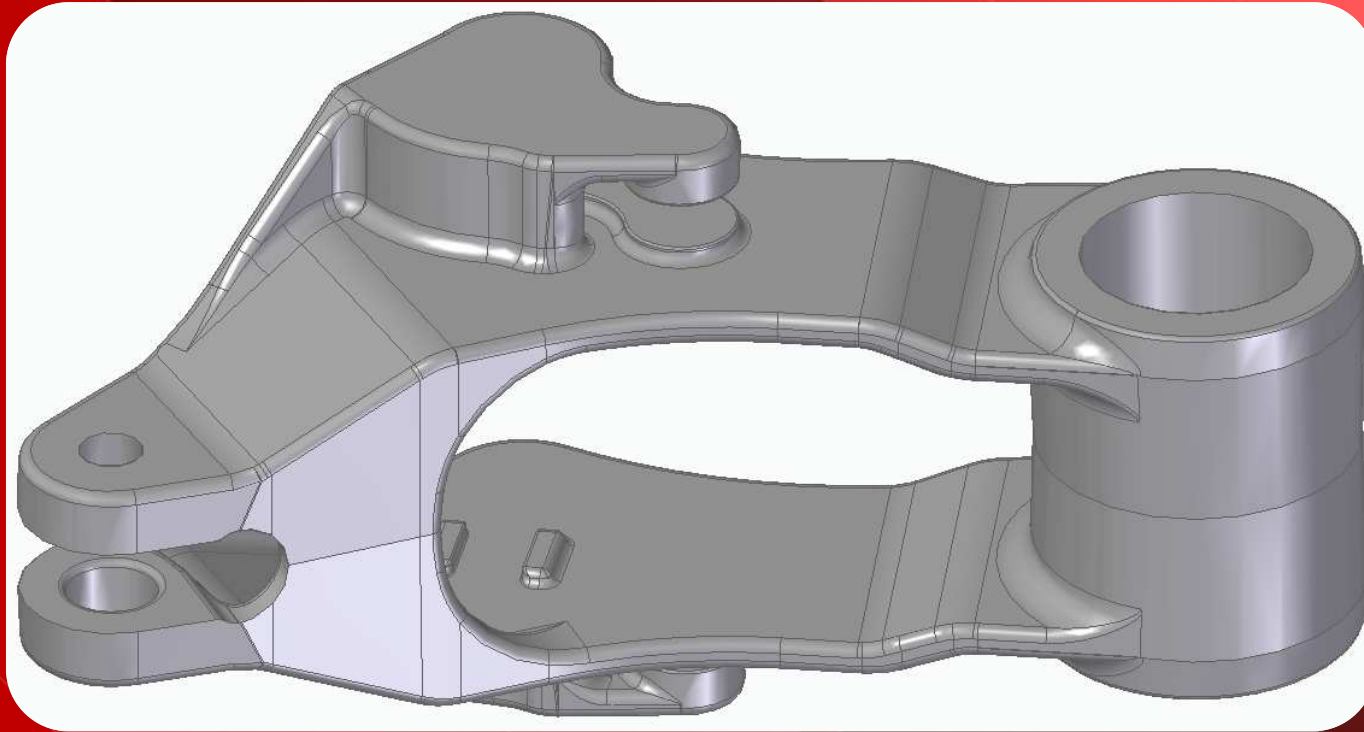




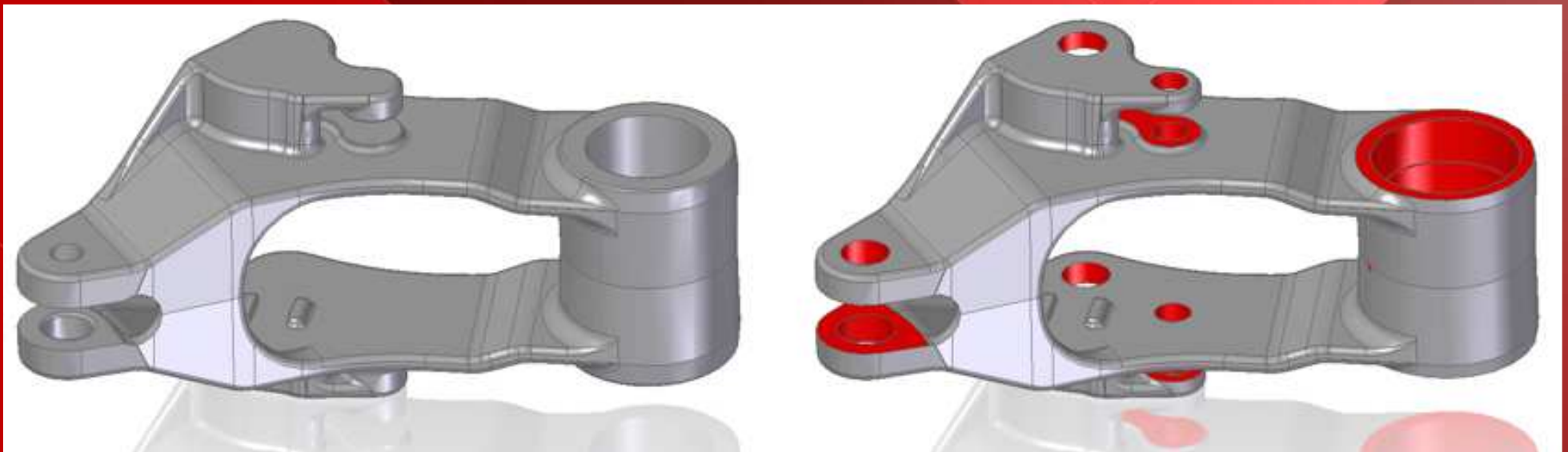
EXAMPLE:
WELDED -> CASTED



EXAMPLE:
WELDED PART – 12 WELDED ELEMENTS



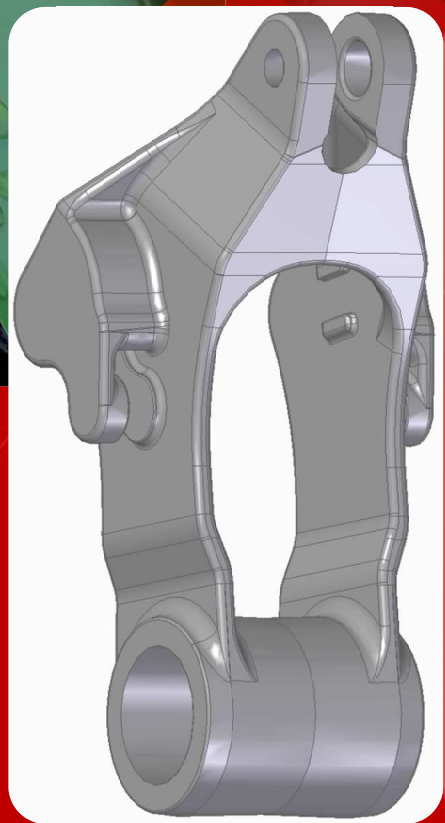
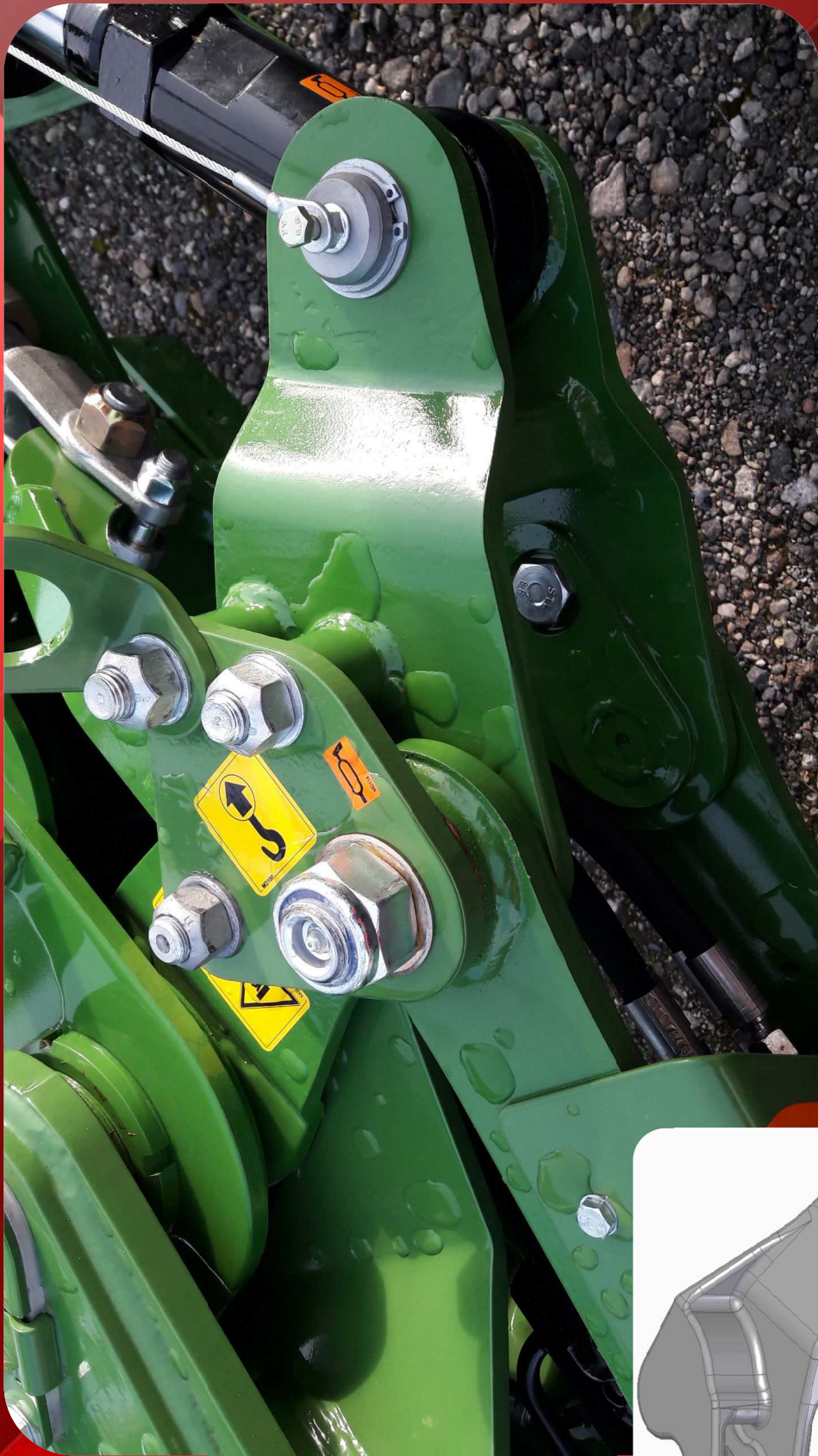
EXAMPLE:
CASTED PART

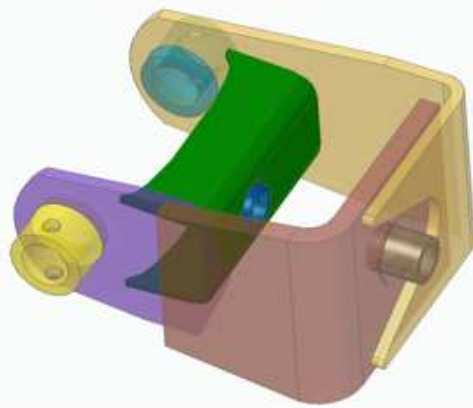


EXAMPLE:

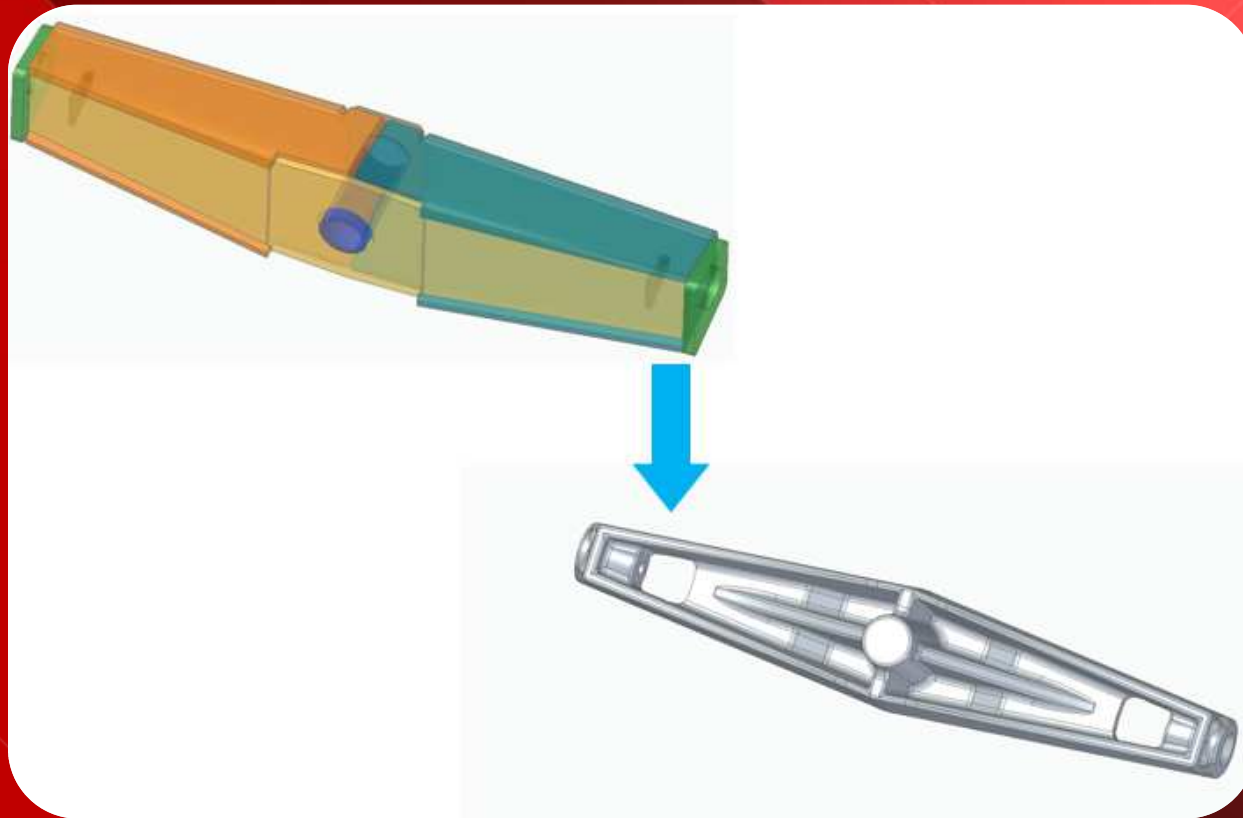
MATERIAL: EN-GJS-600-10 ACC. EN-1563

RESULTS / TESTS: RV2 ACC. DIN 1690 / MS3 ACC. DIN 1690

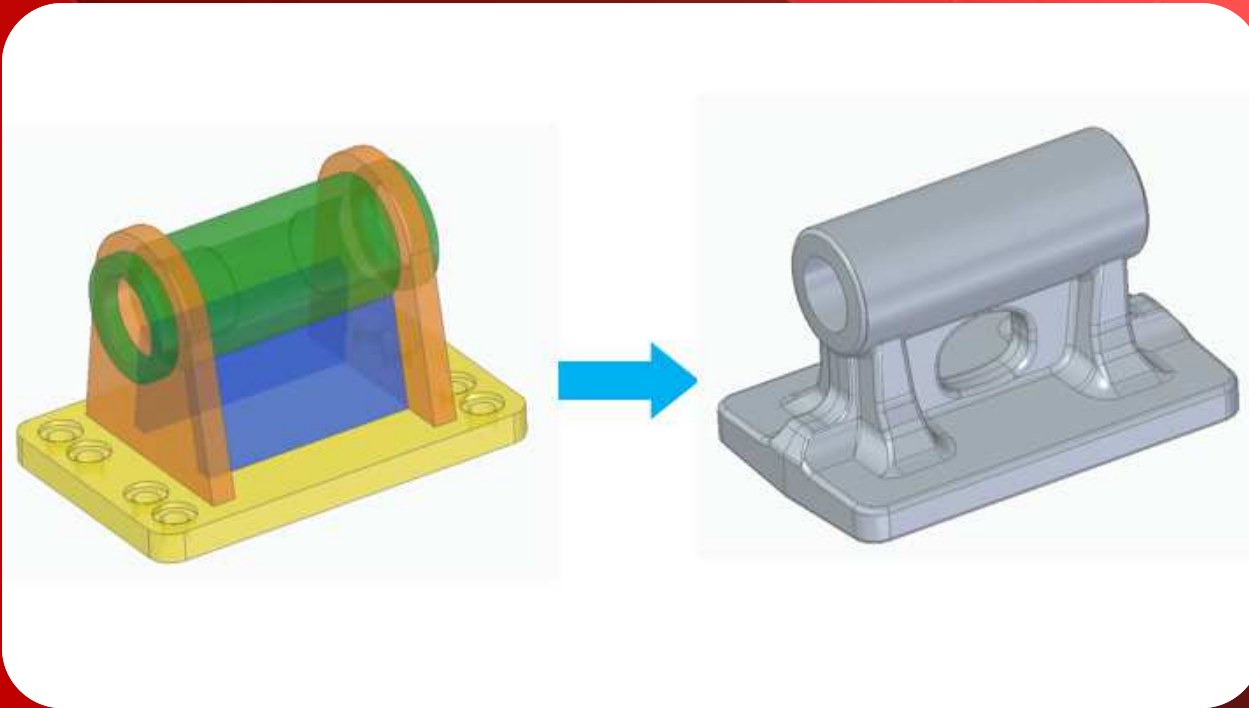




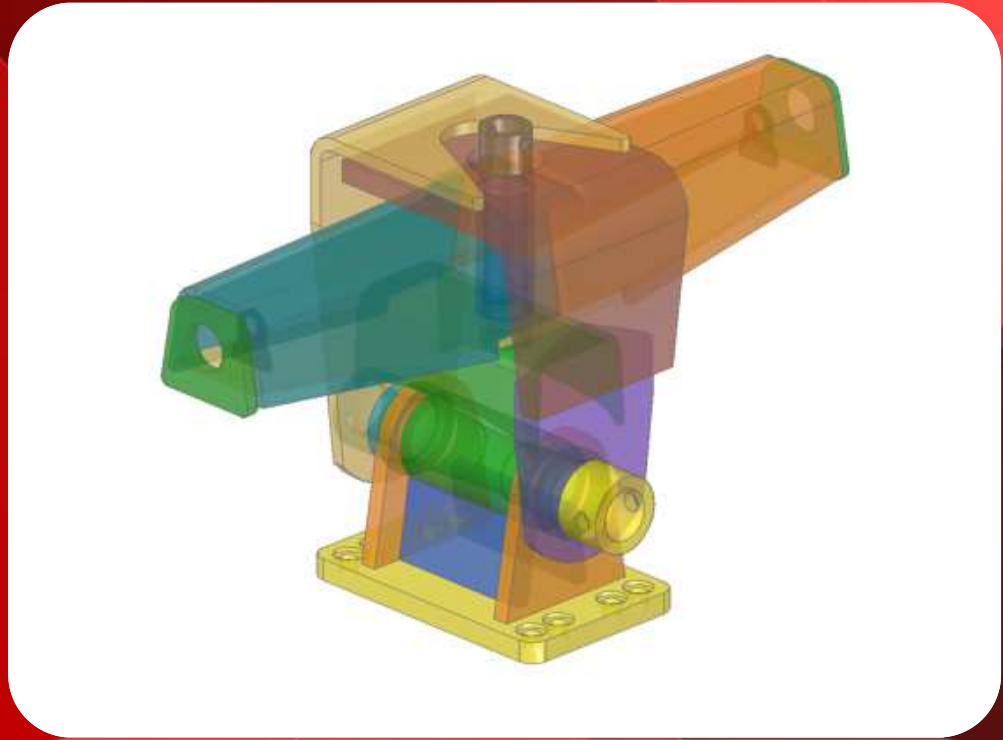
EXAMPLE:
7 WELDED ELEMENTS



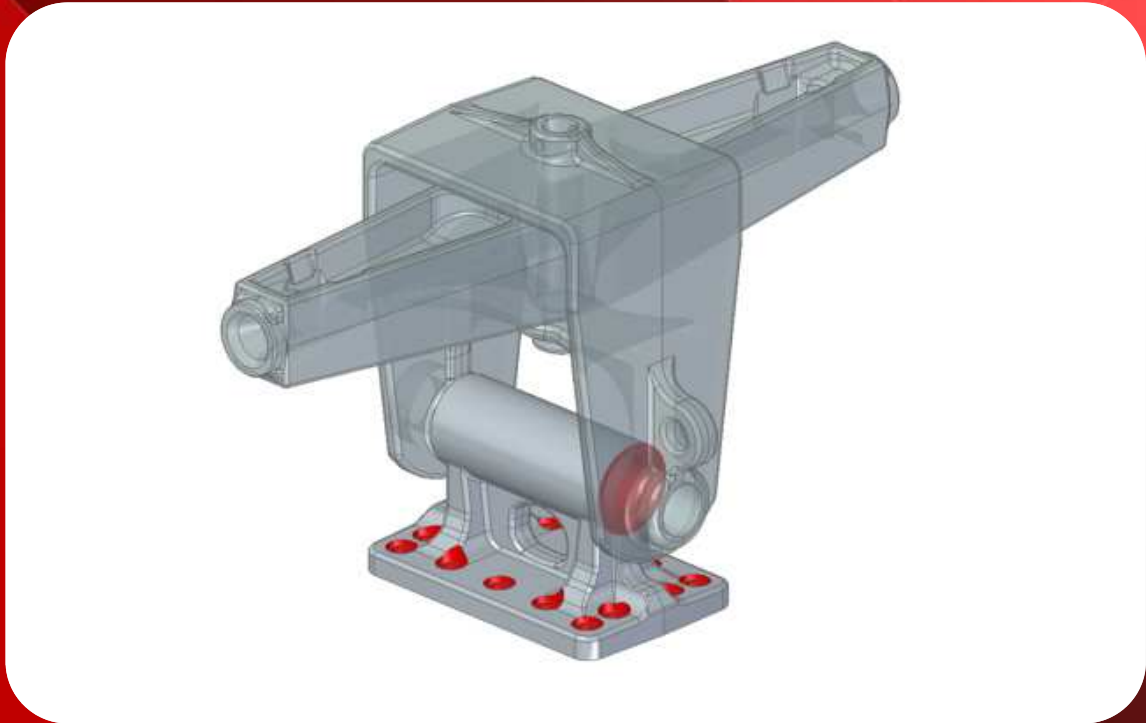
EXAMPLE:
9 WELDED ELEMENTS



EXAMPLE:
8 WELDED ELEMENTS

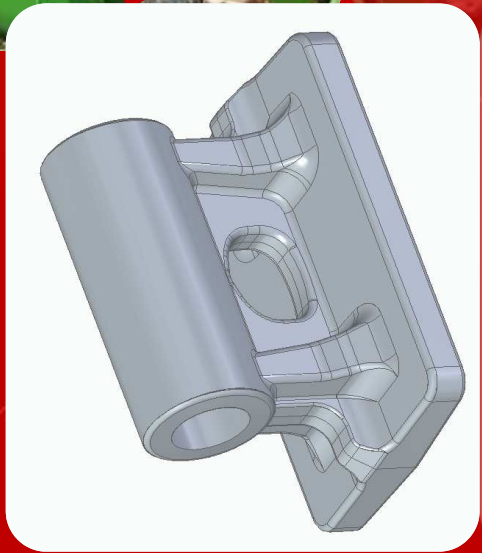


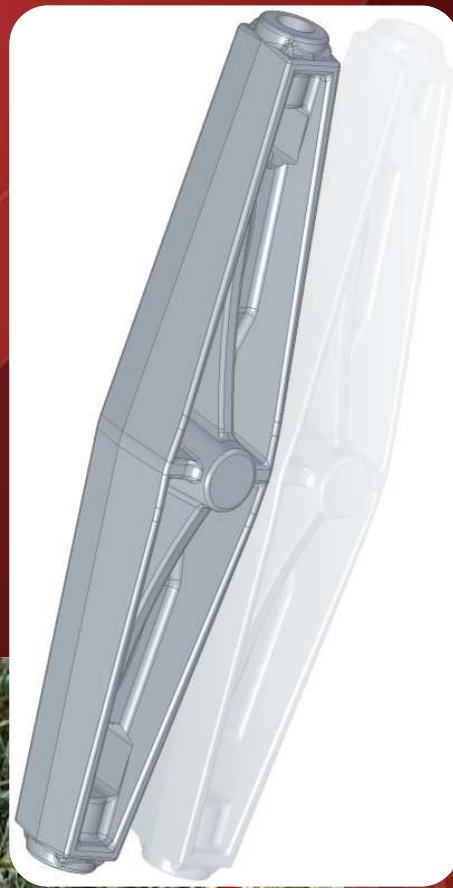
EXAMPLE:
ASSEMBLY OF THE WELDED PARTS



EXAMPLE:
ASSEMBLY OF THE CASTED PARTS



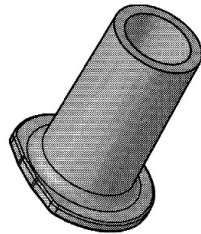
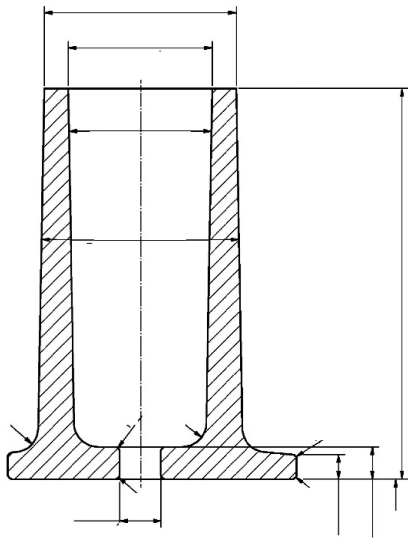
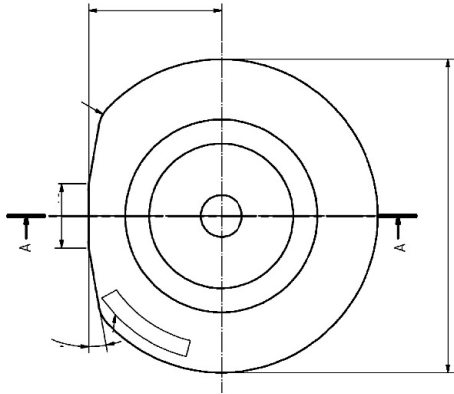






RAILWAY CASTINGS

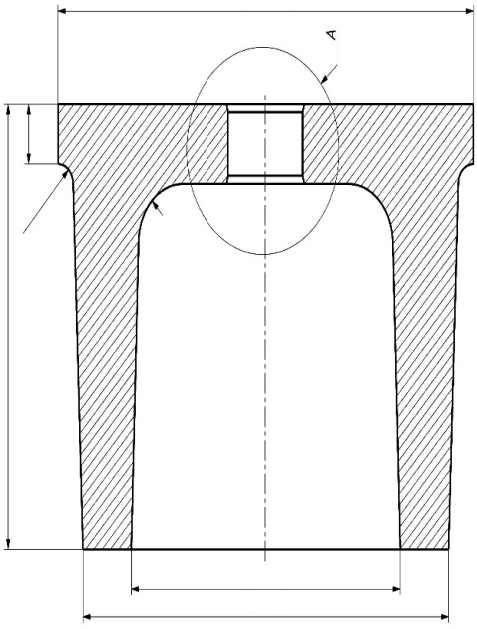
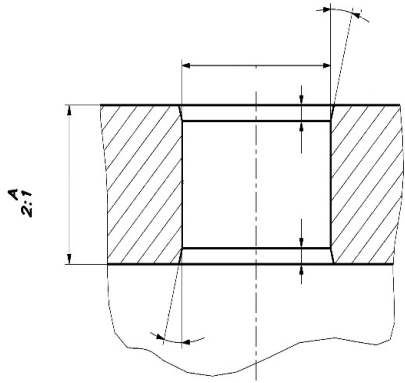
RUNNING PROJECTS & FUTURE PROJECTS





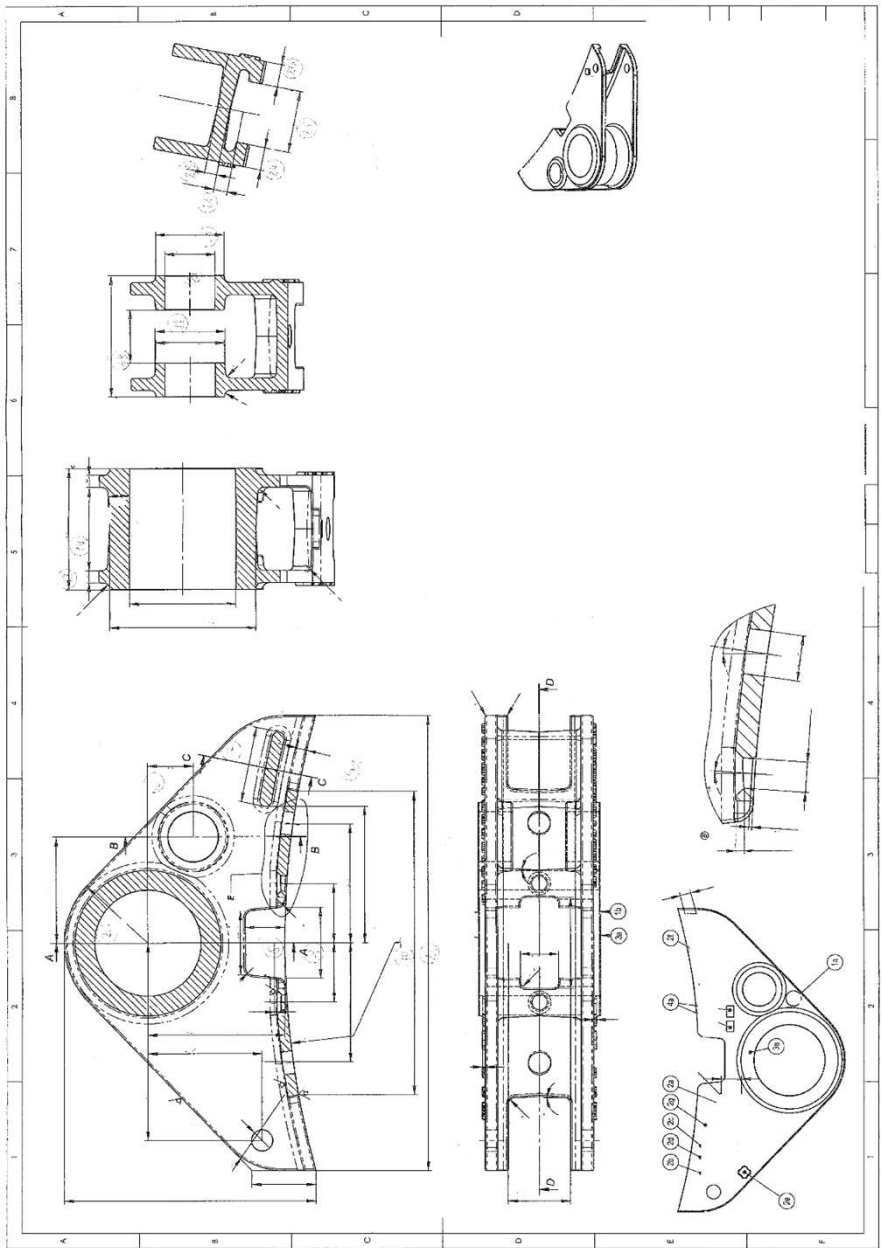
MATERIAL: EN-GJS-400-15

WEIGHT: 13,8 KG





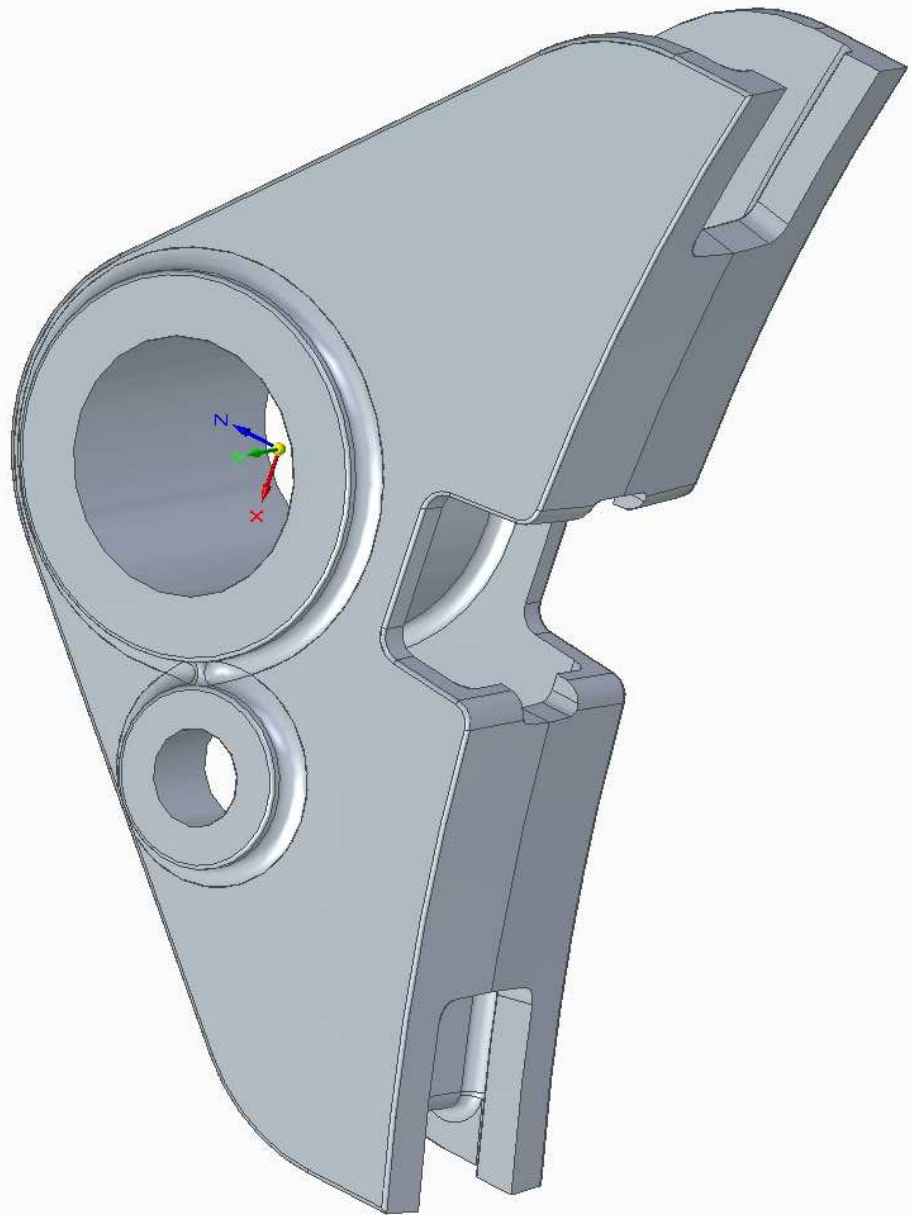
MATERIAL: EN-GJS-400-15
WEIGHT: 6,6 KG

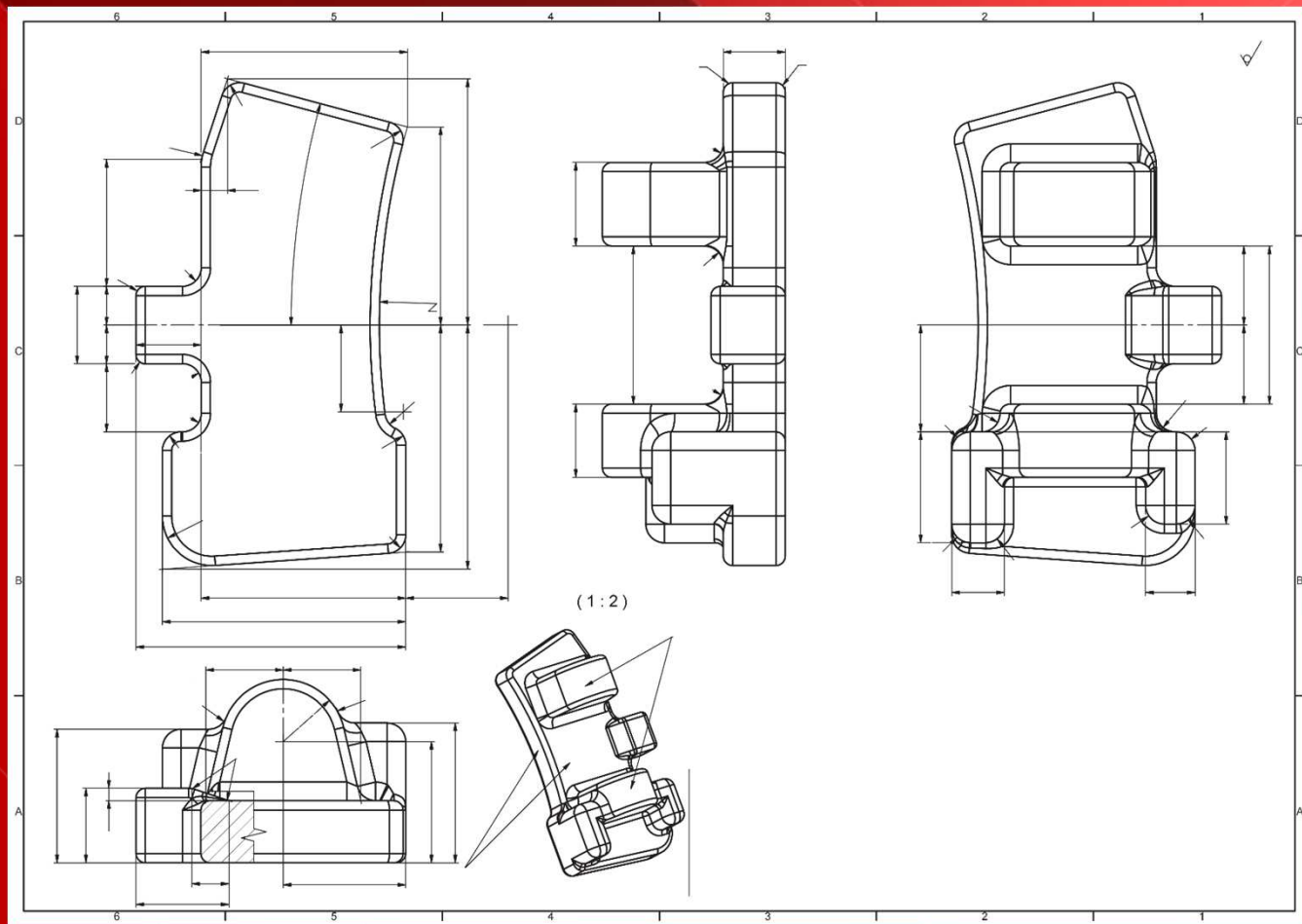




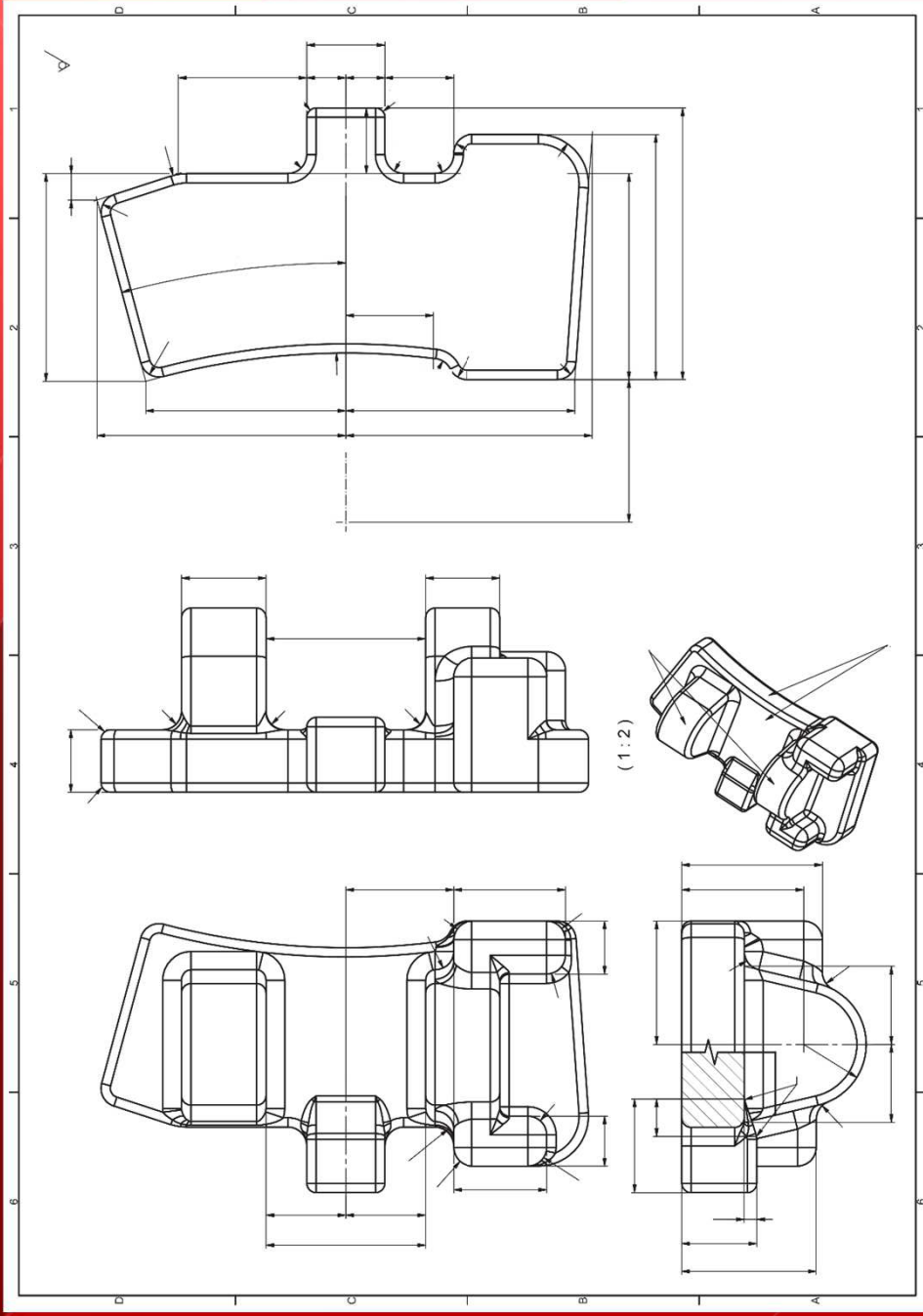
MATERIAL: EN-GJS-400-18 LT

WEIGHT: 6,1 KG



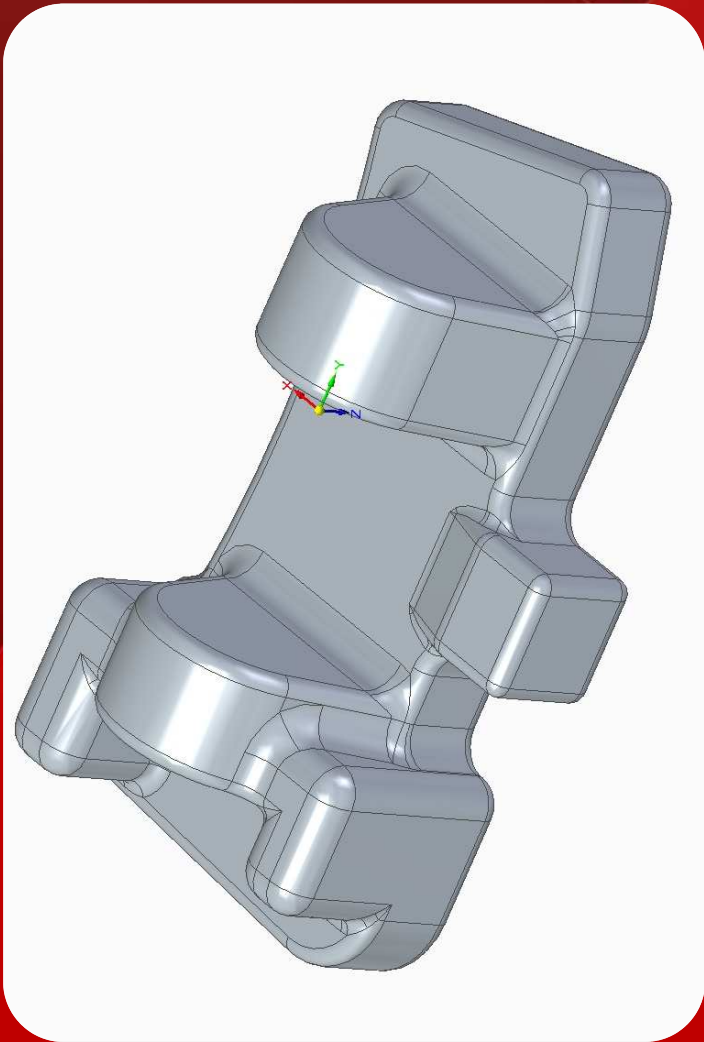
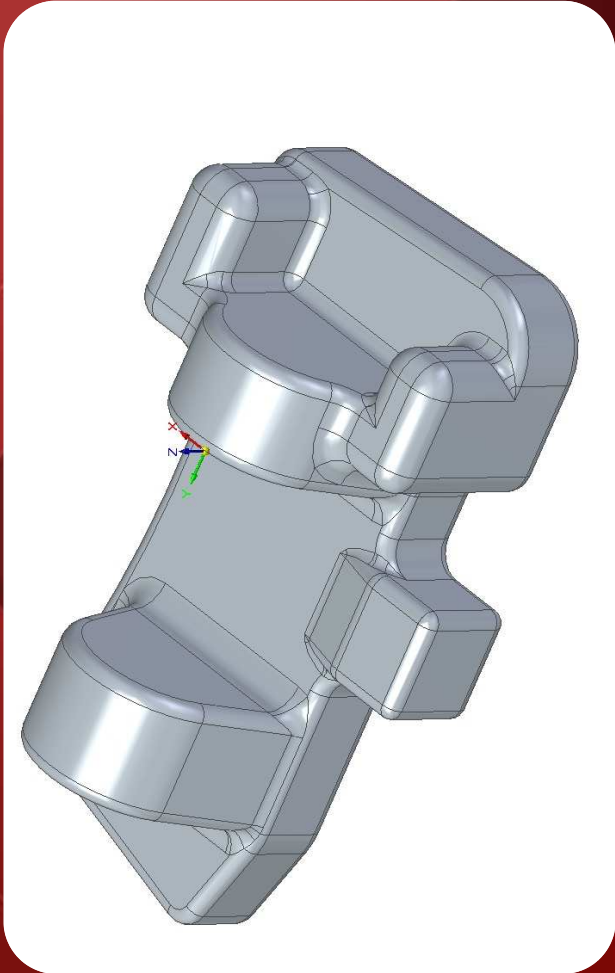


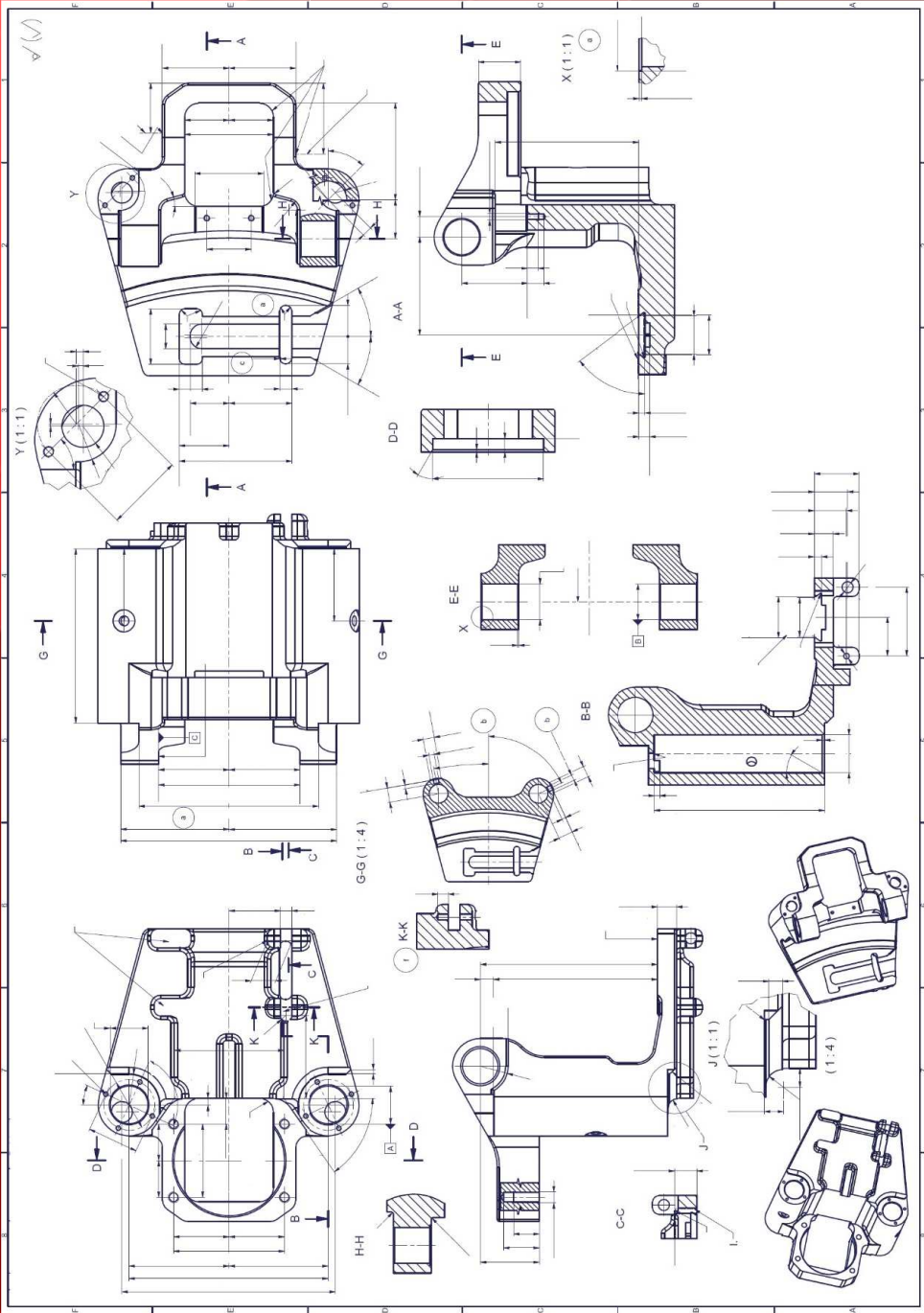
HOLDER CASTING - RIGHT:
TECHNICAL DRAWING





MATERIAL: EN-GJS-400-18 LT
WEIGHT: 2,3 KG

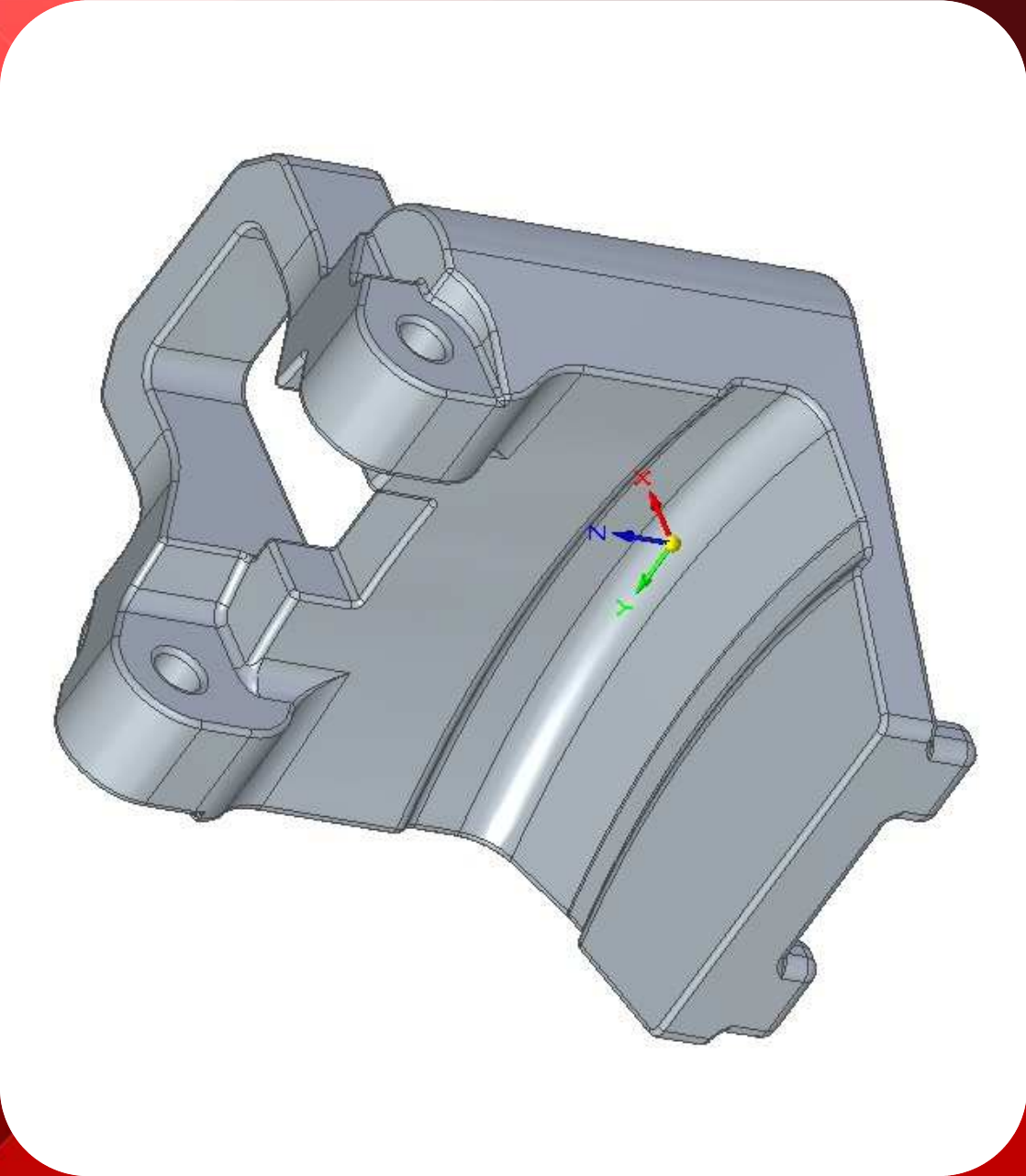


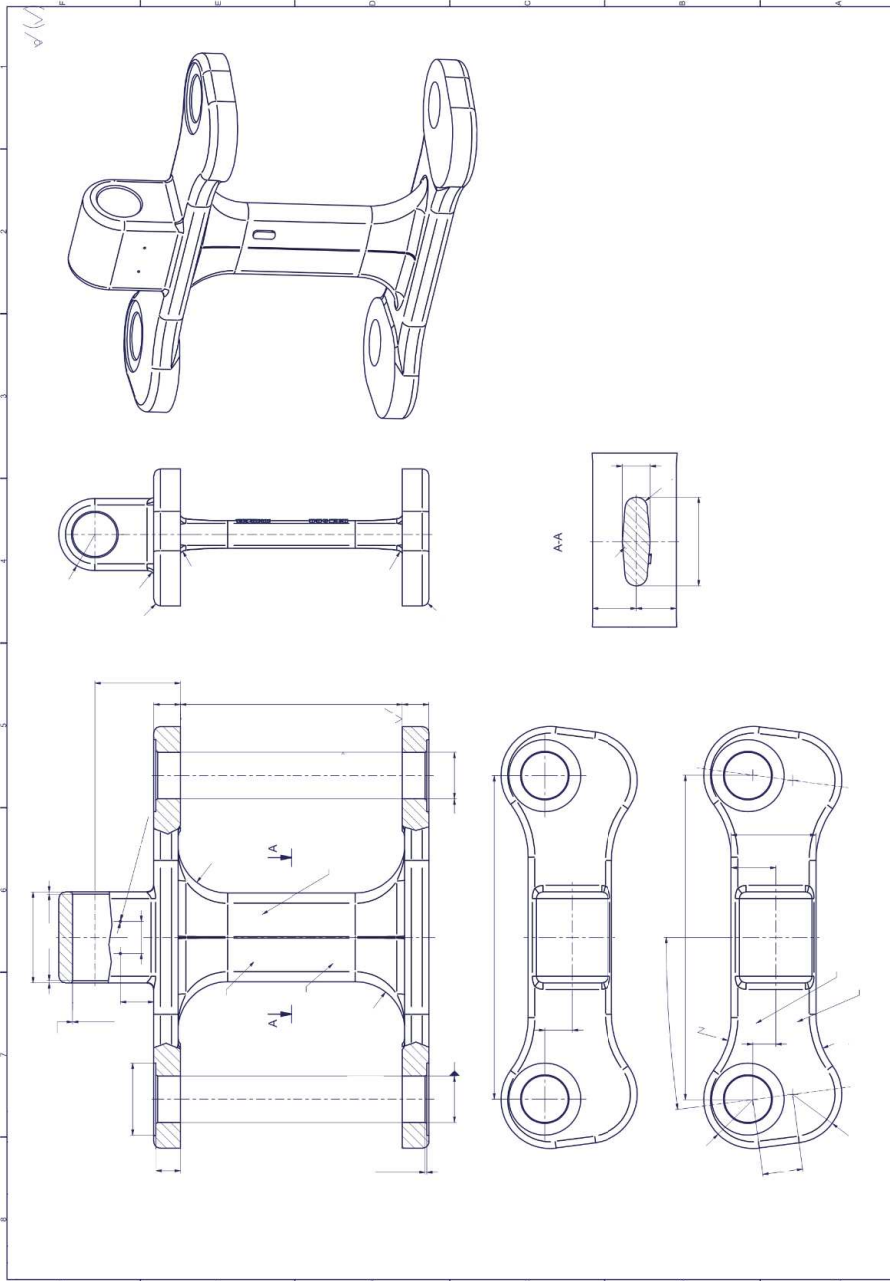


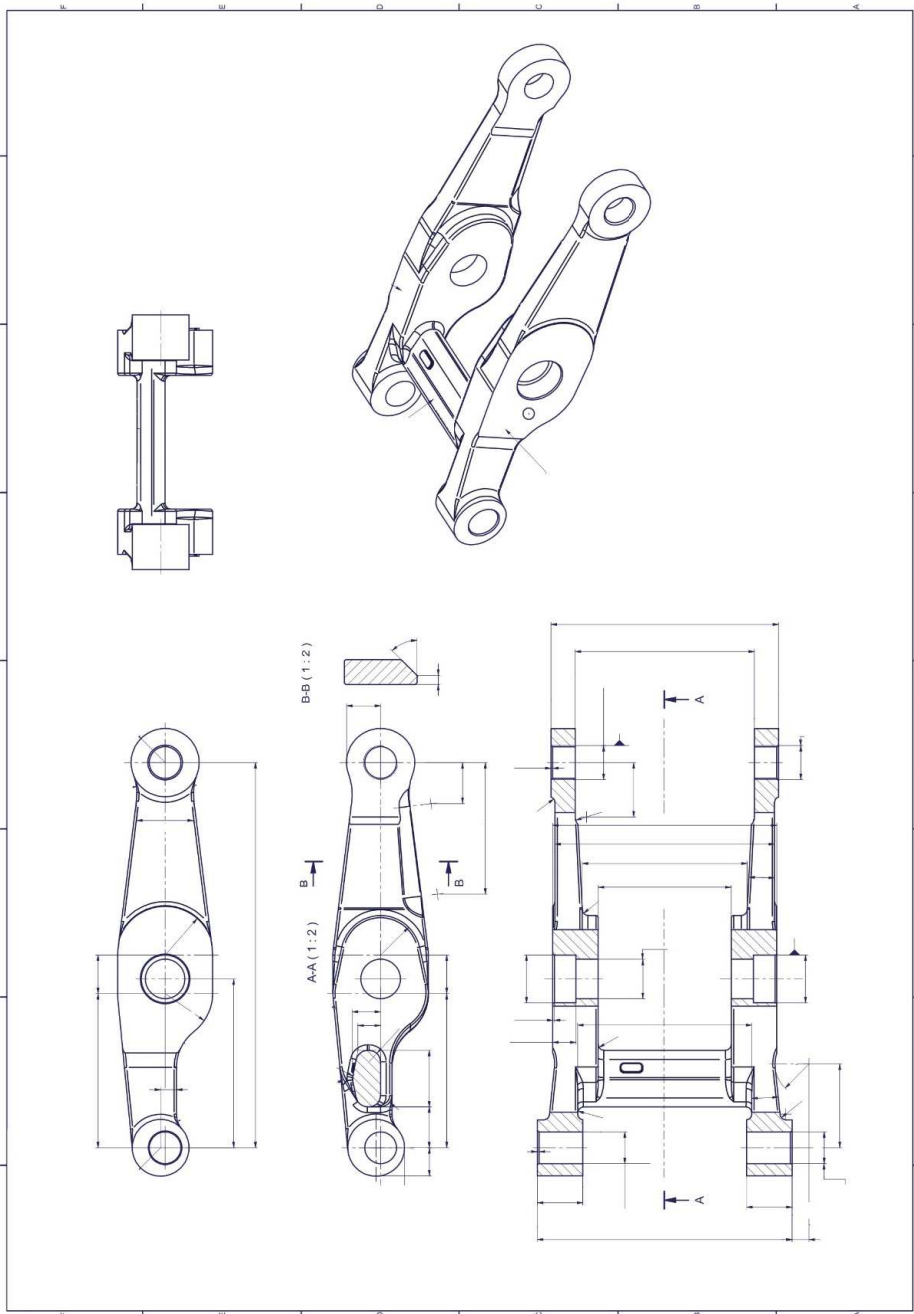


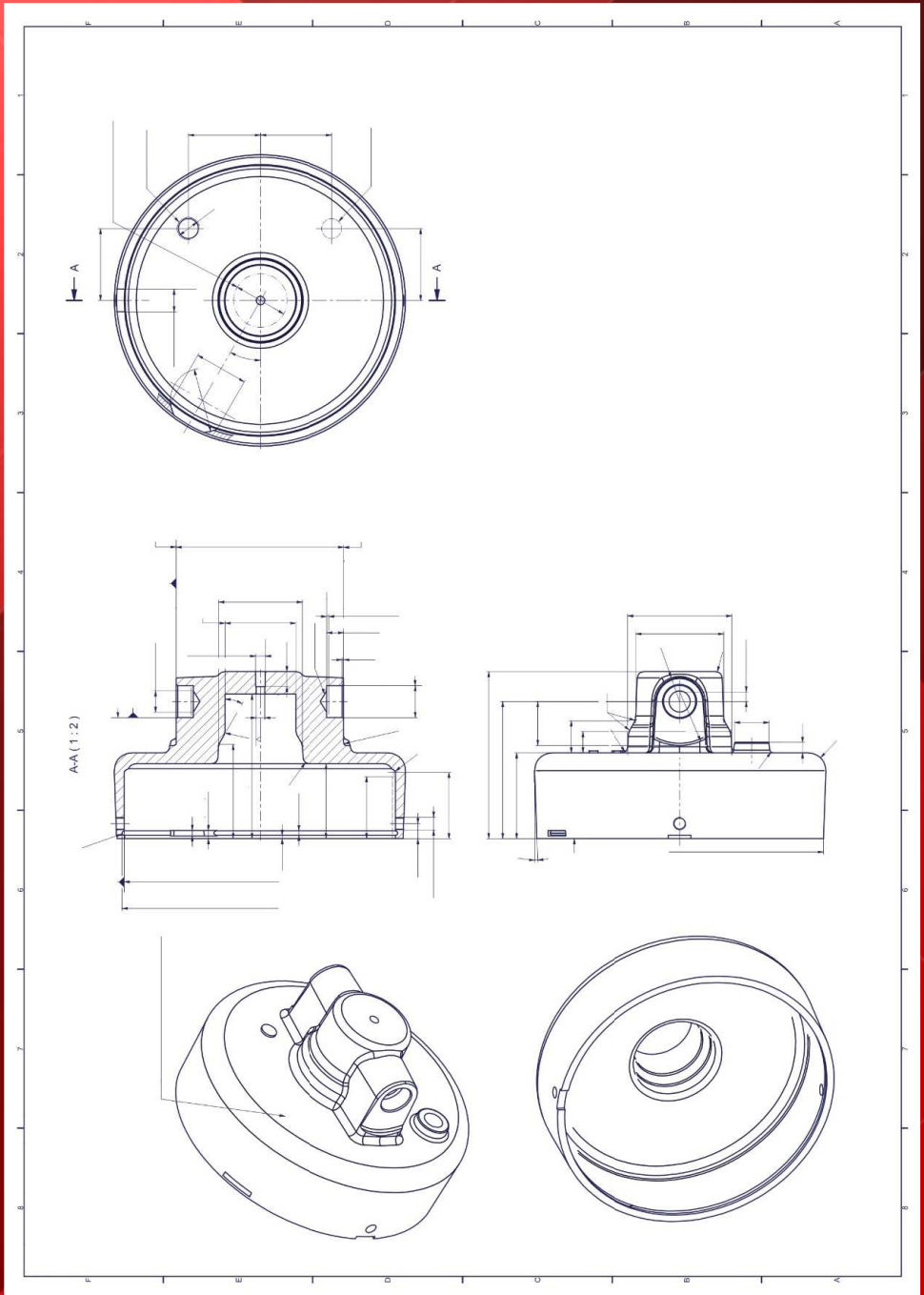
MATERIAL: EN-GJS-400-18 LT
WEIGHT: 21,1 KG



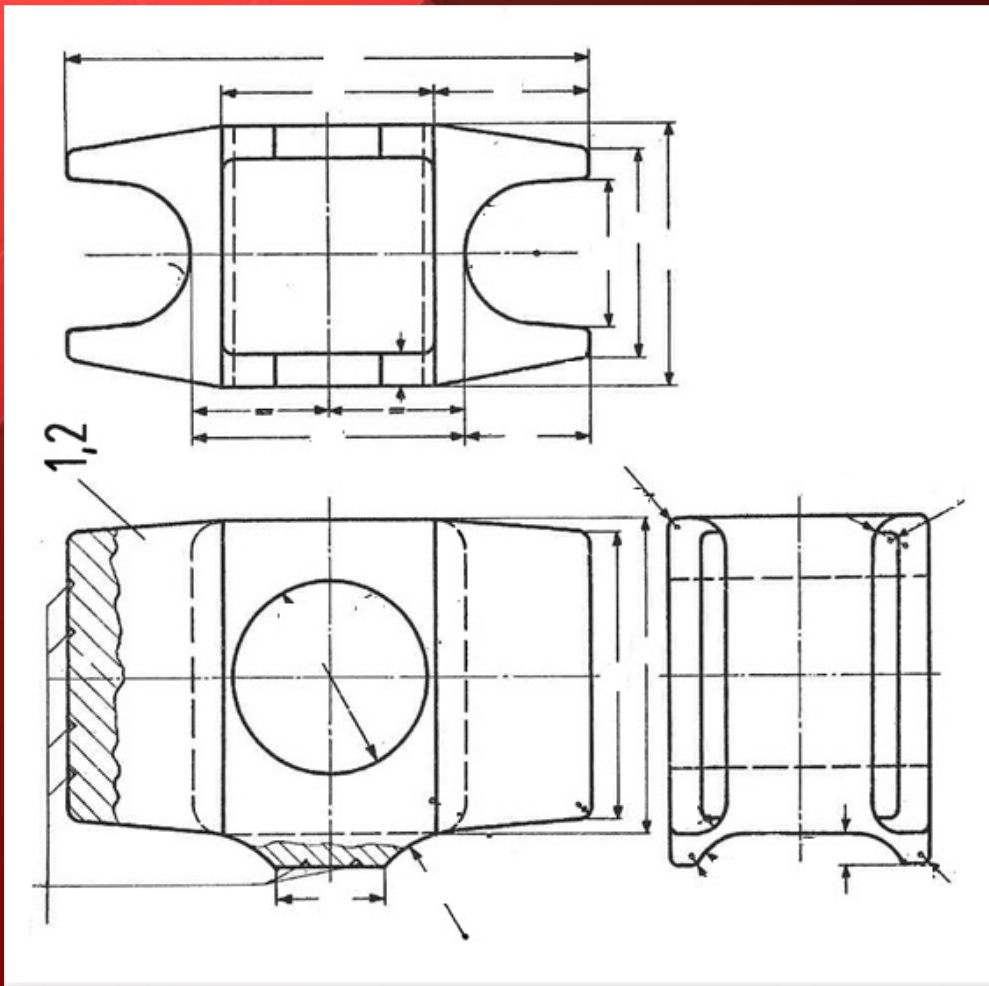


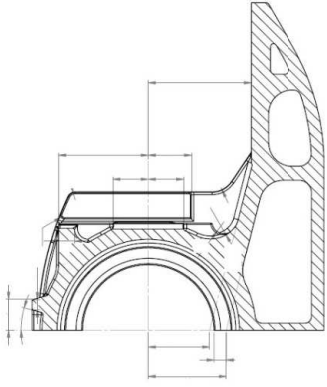




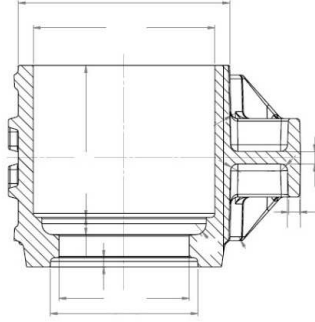




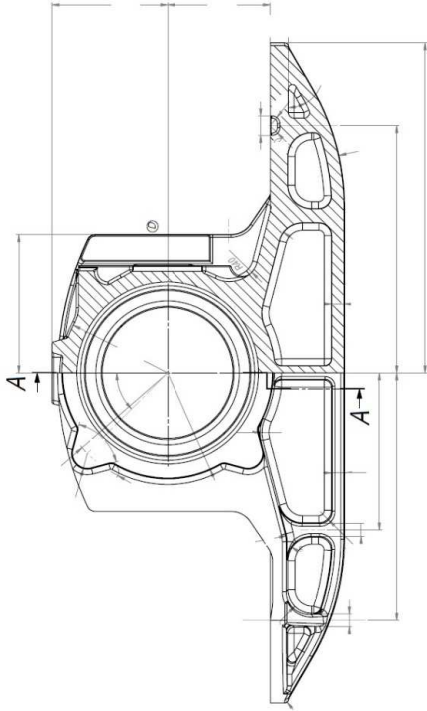




SECTION B-B

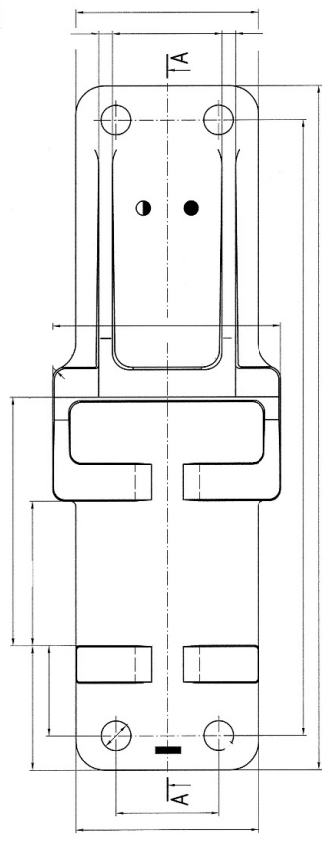
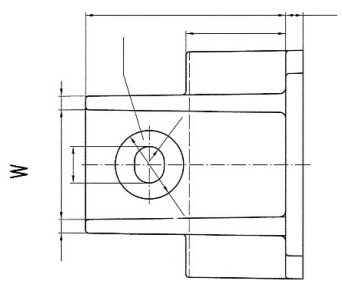
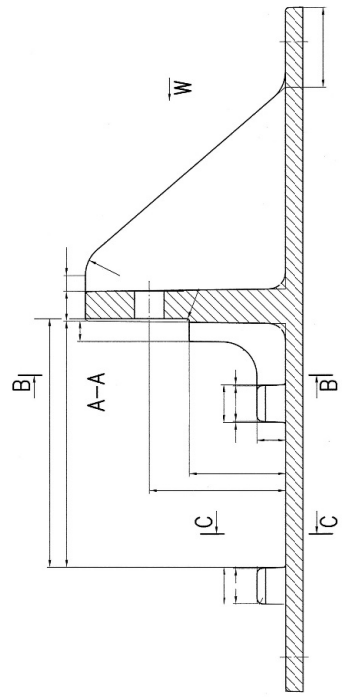
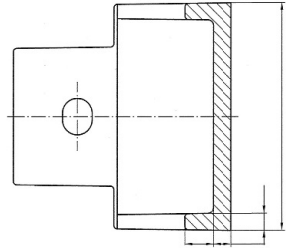


SECTION A-A

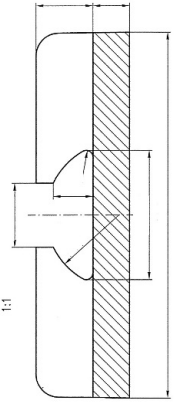


B-B

√(✓)



C-C





MATERIAL: EN-GJS-400-18 LT
WEIGHT: 24,4 KG



170310

° 61

305 000

1701-000

EN-GJS



TERIEL
GOSTYŃ

WE CAST THE FUTURE

