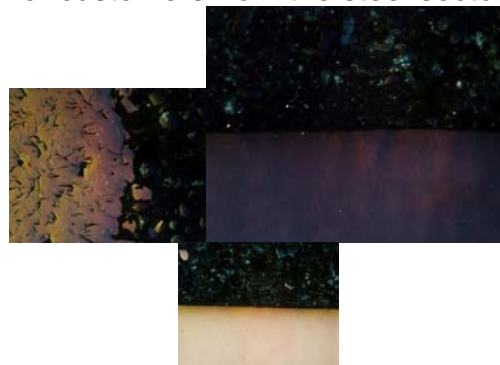


MM-Info „Steel“

Info folder with branch specific information of chosen PolymerMetals
for customers from the steel sector



MultiMetall
the MetalExistenceCompany®

PolymerMetall® • MultiMetall® • Ceramium® • Molymetall® • Sealium® • XETEX®

MultiMetall is the manufacturer of PolymerMetall®.

For more than 40 years MultiMetall invests in polymer-metallic material technologies for the maintenance of metals and alloys.

In the fight with these special tasks our polymer-metallic materials are professionally equipped.

Tough hard, wear resistant and long-lived – even under more difficult conditions.

Successful on oily or under water lying repair areas.

Good to exceptionally good is the assessment as per certificate 301954. (Lloyds Register of Shipping)

Superiority due to mechanical physical data, which counteracts the constant load.

The continuous compressive strength under load can be more than 160 MPa.

A force of 245 MPa is necessary to reach the upper limit. (test report Fraunhofer Institut Germany)

Difficult to damage when attacked by chemicals e.g. acids, alkaline solutions, solvents, salts, gases etc.

PolymerMetall® has a high potential of research and development.

The equipment that lets metals live longer.

MultiMetall

the MetalExistenceCompany®



PolymerMetall® for the repair of metallic devices

www.polymermetal.com

MultiMetall

P.O. Box 12 02 64 / 41720 Viersen / Germany

Tel: +49-2162-97009-0 / Fax: +49-2162-97009-11

info@polymermetal.com / www.polymermetal.com



PolymerMetall®

Introduction

MultiMetall Germany invests for more than 40 years in polymer-metallic material technologies for the maintenance of metals and alloys. In plants and constructions often functional particularly important components are exposed to stresses like break, tear, corrosion, cavitation, chemical or thermal demands. Components treated with PolymerMetals can be preventatively protected against above mentioned stresses. Furthermore MultiMetall's cold repair technology facilitates a gentle material treatment and a durable repair of damaged parts.

Wherever technical security is concerned, PolymerMetals offer the required quality. Certificates from classification societies, test results from research laboratories as well as positive evaluations from customers worldwide verify that fact. Even at problematic surfaces, on oil, grease, fuel or under water, PolymerMetals are used. This technology is called „direct-MM-bonding“.

PolymerMetals - Excellent properties

Engineers and technicians need to have a clear picture of the quality of the products available on the market to be able to choose the best product. Therefore we decided to list excellent properties of different MultiMetall-products in the following overview. Please make your own comparison and let the figures speak for themselves.

Compressive strength (DIN ISO 604):	211 MPa
Compressive strength after post-curing (DIN ISO 604):	245 MPa
Flexural strength (DIN 53452):	110 MPa
Hardness (DIN 50351):	55 Brinell
Modulus of elasticity at 20 °C (DIN EN ISO 6721-5):	15.600 MPa (2.262.000 psi)
Modulus of torsion at 20 °C (DIN EN ISO 6721-2):	5.900 MPa (855.500 psi)
Corrosion:	none
Electrochemical corrosion (DIN 50900):	none
Resist against internal pressure:	300 bar
Totally cured at temperatures up to:	minus 30 °C
Total curing time:	3 min
Repairs in high temperature range at metal temperatures up to:	300 °C
at water cooled metal surfaces up to:	550 °C
Repairs of all metals and alloys	
Application of oily, greasy or fuel contaminated metal surfaces	
Application under water or on wet metal surfaces	
Surface protection against erosion, abrasion, cavitation & corrosion	
Chemical resistance very high against acids, lyes & solvents	
Storage over 5 years without any loss of quality possible	

Acceptance by classification societies

American Bureau of Shipping • China Classification Society • Det Norske Veritas • Germanischer Lloyd • Lloyd's Register of Shipping • Nippon Kaiji Kyokai • Russian Type Approval

Availability

Technical data sheets are generally available in German or English language. PolymerMetals are only produced in Germany and delivered worldwide within short time by MultiMetall. In addition to that our products are internationally available from many MultiMetall-partners. Ask for further products from MultiMetall.

Repair of components with PolymerMetals

air sleeves • axles • bearing housings • bearing seating • boiler • bridge bearings • compensators • compressors • condensers / capacitors • conveyor belts • cooling tubes • cyclone • cylinder barrels • cylinder sleeves • engine blocks • engines • exhaust pipelines • exhaust pipes • exhaust turbines • gaskets • gearbox housings • guide rails • heat exchangers • housings for gas inlet and outlet • hulls • hydraulic cylinders • hydraulic oil pipes • hydraulic pistons • impellers • kort nozzles • oil coolers • oil pipelines / oil feed pipes • oil tanks • petrol pipelines / petrol feed pipes • petrol tanks • plain bearings • plungers • propellers • pumps • rudder bearings • seals • shaft plates • shafts • slab frames • spline shafts • steam pipelines / steam feed pipes • tappet guides • transformers • turbine housings • turbochargers • V-grooves / keyways • valve housings • valves • vibration dampers • water coolers • water pipes • water tanks

Trademarks

MultiMetall®
 PolymerMetall® • Ceramium®
 Molymetall® • Sealium® • XETEX®

Reference list (Extract of German customers)

ABB AG • AG der Dillinger Hüttenwerke • AIDA Cruises • Alstom Power Service GmbH • Atlas Copco Energas GmbH • Blohm + Voss Industrietechnik GmbH • Bombardier Transportation GmbH • BVG Berliner Verkehrsbetriebe • Carl Büttner Ship Management • Continental AG Automotive Systems • Daimler AG • DB AG • Deutsche BP AG • Deutz AG • E.ON AG • ENSO Energie Sachsen Ost AG • Erdgas Südsachsen GmbH • Europipe GmbH • Evonik Power Saar GmbH • German Tanker Shipping GmbH & Co. Ship Owners & Tanker Operators • HeidelbergCement AG • Henschel Industrietechnik GmbH • HKM Hüttenwerke Krupp Mannesmann GmbH • Holborn Europa Raffinerie GmbH • IVECO Motors FPT Deutschland • K + S KALI GmbH • KKW Krümmel • KKW Brokdorf • KS Aluminium-Technologie GmbH • KSB AG • LEW Lechwerke AG • LH Luitpoldhütte AG • MAN Diesel SE • Metalock Industrie Service GmbH • MTU Friedrichshafen GmbH • N-ERGIE AG • Norddeutsche Reedereien H. Schuldt GmbH & Co KG • PCK Raffinerie GmbH • Peiner Umformtechnik GmbH • Pirelli Kabel & Systeme GmbH & Co.KG • Porsche AG • Ruhrpumpen GmbH • RWE AG • Saarstahl AG • Salzgitter AG • Shell Deutschland Oil GmbH • Siemens AG Power Generation • Stadtwerke München • Stadtwerke Trier • ThyssenKrupp Industrieservice GmbH • ThyssenKrupp Marine Systems Blohm & Voss Repair GmbH • ThyssenKrupp Steel Europe AG • Vattenfall Europe AG • ZF Friedrichshafen AG

MultiMetall

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Overview product range

MM-metal SS-steelceramic

MM-metal SS-steelceramic is the PolymerMetal with the widest range of application for repairs and maintenance of all metals and alloys. MM-metal SS-steelceramic offers a very high quality at mechanical repairs of damaged components (e.g. caused by crack, corrosion, abrasion, impact or chemical stress).

Machinability: SiC-grinding plates, Diamond tools

MM-metal SQ

Characteristic for this PolymerMetal are the easy processing and extreme short curing time. The variable mixing ratio offers application consistencies from pasty to liquid. MM-metal SQ can be used at ambient temperatures up to minus 30 °C.

Machinability: standard tools

MM-metal SS-steel 382

MM-metal SS-steel 382 is a PolymerMetal and construction material. The high performance material MM-metal SS-steel 382 delivers the best technical data under mechanical and physical stress.

Machinability: standard tools

MM-metal SS

PolymerMetals of the SS-basis possess very high quality standards for the reconstitution of metallic components. These PolymerMetals are available with the alloy materials steel, aluminium, copper and bronze.

Machinability: standard tools

MM-metal oL-steelceramic

MM-metal oL-steelceramic is a PolymerMetal tested and certified for the repair of oily, greasy or fuel contaminated metals and alloys in case of stress due to cracks, corrosion, abrasion, impact or chemicals. MM-metal oL-steelceramic can also be used to seal oil, grease or fuel pouring from leaks at systems under pressure.

Machinability: SiC-grinding plates, Diamond tools

MM-metal UW

MM-metal UW is a PolymerMetal with extreme short curing time. It is certified for repairs under water or on wet metal surfaces. Possible application areas of MM-metal UW are the repair of under water components or the sealing of leaks. MM-metal UW can also be used to seal water pouring from leaks at systems under pressure.

Machinability: SiC-grinding plates, Diamond tools

Ceramium®

Ceramium offers maximum wear resistance against continuous material loss on metallic surfaces. With tough hard layers, Ceramium protects against erosion, abrasion, cavitation or corrosion in case of dry or wet or chemical stress.

Machinability: SiC-grinding plates, Diamond tools

Ceramium® CH

Ceramium CH is a wear resistant Polymer-Ceramic with excellent resistance against chemicals. These include inorganic (mineral) and organic (carboxylic) acids - also in concentrated form – as well as halogenated and aromatic hydrocarbons, ester, ketone, alcohols, bases and oxidising salt solutions.

Machinability: SiC-grinding plates, Diamond tools

XETEX® BD

XETEX BD is a cold-setting two-component construction adhesive on basis of epoxy resin / ceramic, which has been developed for high-strength bonding. The application is the joining of materials (e.g. metals, ceramics and plastics) with very high strength at high mechanical, static and dynamic loads.

VP 10-017

VP 10-017 is a tough elastic PolymerCeramic with high impact and cavitation resistance. This extremely smooth surface protection provides a good resistance against chemicals and has a high mechanical-physical load capacity.

VP 10-500

VP 10-500 is a PolymerMetal for repair and maintenance of metals in the high temperature range. It is a hot-hardening material which does have a clearly higher temperature resistance than cold-hardening polymer materials. A high chemical resistance especially against sulphuric acid is given.

Machinability: SiC-grinding plates, Diamond tools

Molymetall®

Molymetall is a PolymerMetal with a very low coefficient of friction and self-lubricating properties. The emergency running properties against solid dry friction such as sliding wear and stick-slip are excellent. After curing, Molymetall can be processed to a finished measure up to the μ -area.

Machinability: standard tools

Sealium®

Mostly Sealium is used as sealant and sealing of metallic casting materials. Furthermore alloys and thermal coated components can be treated with Sealium. As a one-component material with extremely high capillary activity, Sealium penetrates micro-porosities or hairline cracks and reacts in the structure of the metallic material.

MM-metal S

PolymerMetals of the S-basis are used for removing bubbles in cast parts, for quick repairs and for visual improvements. MM-metal is available with high metal filling particular for the cast materials steel, iron, aluminium, copper and bronze.

Machinability: standard tools

MM-Elastomer

MM-Elastomer is a material with rubber-like characteristics. Using MM-Elastomer elastic connections can be created or components repaired which are e.g. subject to abrasion. The range of MM-Elastomer goes from Shore A hardness 40 to 95.

PolymerMetall® • MultiMetall® • Ceramium® • Molymetall® • Sealium®
XETEX® • the MetalExistenceCompany®
are registered trademarks of MultiMetall

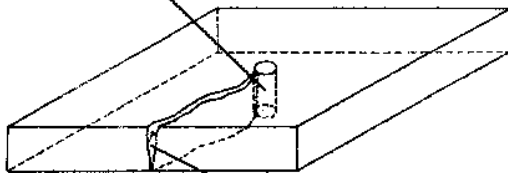
TEC-# 016

Sample applications

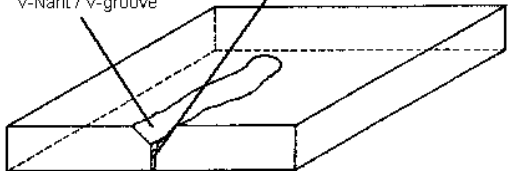
Used products

PolymerMetals

Rissende ausgebohrt / crack end drilled out



V-Naht / V-groove



Riss / Crack

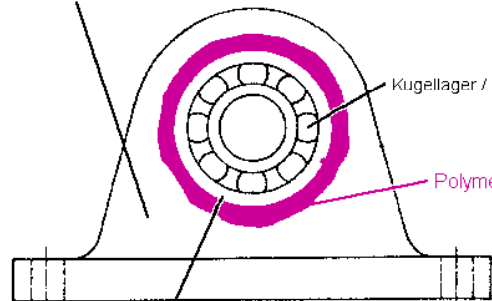
appliziertes PolymerMetal /
applied PolymerMetal



Reparaturstelle nach Bearbeitung /
Repair site after machining



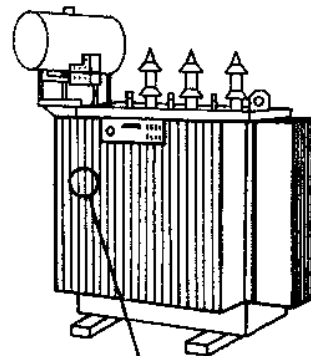
Lagerblock / pillow block



Kugellager / Ball bearing

PolymerMetal

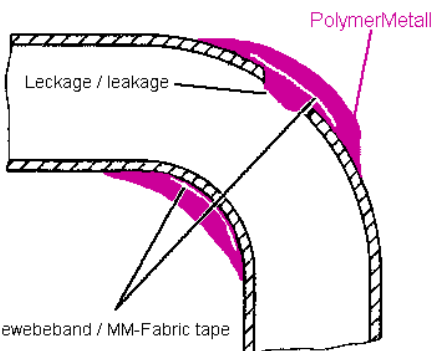
MM-Trennmittel / MM-Release agent



PolymerMetal



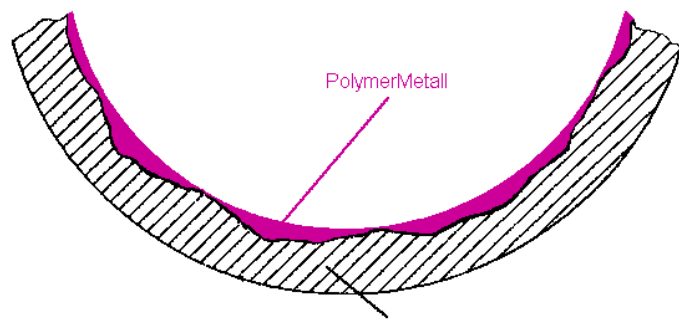
Leckage mit Flüssigkeitsaustritt /
leakage with liquid pouring out



Leckage / leakage

PolymerMetal

MM-Gewebeband / MM-Fabric tape



PolymerMetal

verschlissenes Pumpengehäuse / worn pump casing

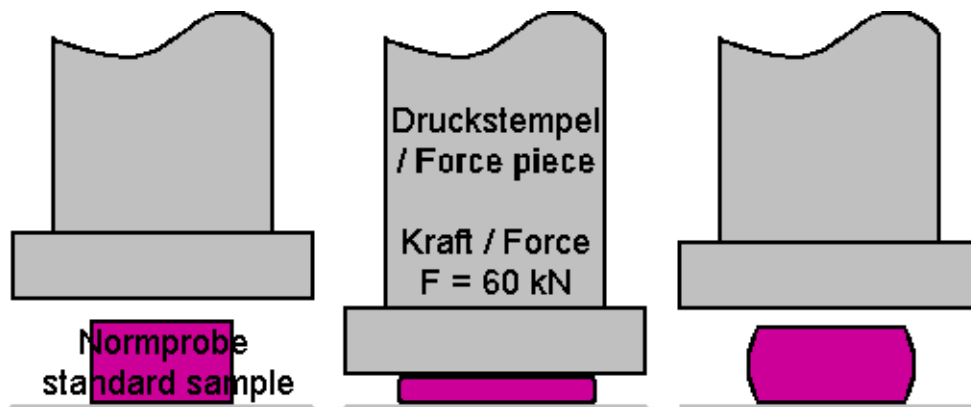
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TEC-# 015

Compression strain test

Used products

MM-Elastomer



Description

As you can learn from this test, MM-Elastomer disposes high impact strength, hardness and low distortion rest despite of this high use. Furthermore no cracks or excavations could be found after the test. MM-Elastomer is especially suitable for the production of shock and vibration absorbers, cyclone coatings and for the repair of pumps, containers, seals and conveyor belts.

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Technical Report PolymerMetal®

TEC-# 007

The corrosion-chemical behaviour of PolymerMetals in combination with casting material (contact corrosion)

Used products

MM-metal SS-steelceramic / MM-metal SQ / MM-metal SS-steel 382 / MM-metal SS-steel / MM-metal oL-steelceramic / MM-metal UW / Ceramium® / MM-metal S-steel

Introduction

PolymerMetals are used for repairs of metallic constructions which were damaged by physical loads like tear, impact, erosion, abrasion, corrosion and cavitation or by chemical load.

Questions of customers concerning the contact corrosion of our PolymerMetals lead us to do tests.

The following report shows how the test has been carried out and what results have been obtained. Tests have been made with seven different PolymerMetals in artificial sea water (laboratory test) as well as in aggressive marshy soil. The PolymerMetals used were potentially equivalent or potentially superior to the base material (cast iron).

Place of repair

Moorland in the North of Germany and laboratory

Preparation of test samples

56 plates measuring 150 x 95 x 25 mm and 95 x 47 mm have been cut off cast iron. The surface of 23 plates has been treated mechanically. 2-3 bore holes of different diameters were installed in order to create different proportions between cast iron and PolymerMetals.

General information

An ordinary salt spray test proved insufficient. As the tested PolymerMetals are non-electrical conductive products it was decided not to measure the current density potential curves. The contact resistance in the Meg-Ohm-sphere was too high.

Test in moorland

Marshy soil is to be said very aggressive (DVGW rating no. -15 up to -19)

Reasons are:

- very low soil resistance (appr. 950-1200 Ohm x cm)
- very high salt content (chloride 800 - 1250 mg/kg / sulphate 4300 - 19000 mg/kg)
- very high moisture contents (appr. 55 - 85%)
- anaerobic conditions, proved by hydrogen-sulphide

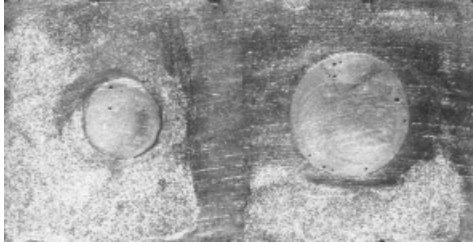
The cast iron plates and PolymerMetals, machined and non-machined, were stored in a considerable depth of marshy soil for more than one year.

Test in artificial see water (laboratory test)

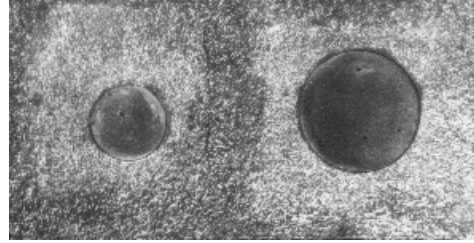
The cast iron plates and PolymerMetals - machined and non-machined - were stored in a laboratory in considerable depth of artificial sea water (DIN 50 900) for more than one year.

Samples

The following photographs show the different PolymerMetals applied to cast iron which have been partly machined after full curing. After they have been stored for 12 months in aggressive moorland or artificial sea water the samples have been examined. The following four photographs concern machined samples which have been exposed to artificial sea water:



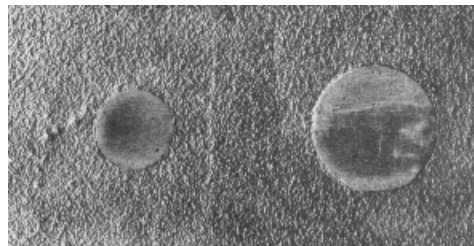
Sample MM-metal SS-steelceramic



Sample MM-metal SS-steel



Sample MM-metal oL-steelceramic



Sample MM-metal UW

Result

The results of both tests were nearly the same. Due to the strong reaction caused by the aggressive soil or by the sea water the cast iron plates were coated with ferric hydroxide. While the surface of the cast iron plates were differently affected, the PolymerMetals still remained unchanged after storage of more than 12 months. They were only covered with rust deposit. Even peak-to-valley heights from previous treatments could clearly be recognised. There was no contact corrosion, not even at the transitional point of the PolymerMetal and the cast iron. It was proved that PolymerMetals are not electrically conductive and cannot constitute any local element with cast iron.

Tested PolymerMetals

MM-metal SS-steelceramic
MM-metal SS-steel 382
MM-metal SS-steel
MM-metal SQ
MM-metal oL-steelceramic
MM-metal UW
Ceranium®
MM-metal S-steel

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Technical Report PolymerMetal®

TEC-# 006

Microscope photographs, direct-MM-bonding, bonding on contaminated surfaces, pressure tight tests

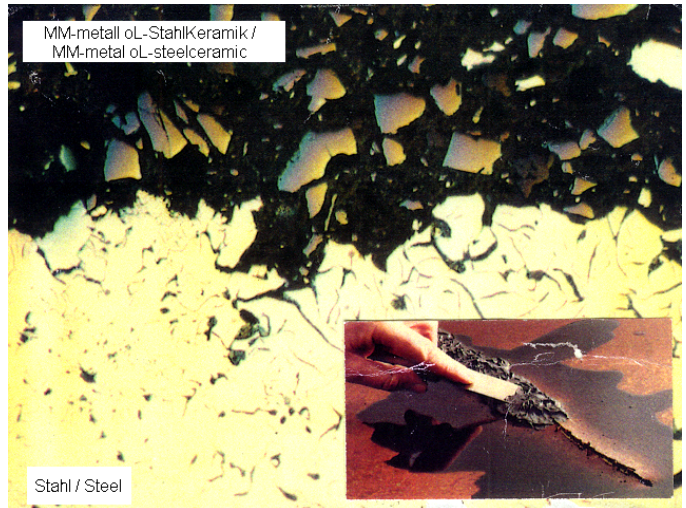
Used products

MM-metal oL-steelceramic

Description

MM-metal oL-steelceramic is a PolymerMetal tested and certified for the repair of oily, greasy or fuel contaminated metals and alloys in case of stress due to cracks, corrosion, abrasion, impact or chemicals. The degree of soiling does not in any way affect the bonding with the structure of the soiled metal surface. High technical data and also the chemical resistance and bonding with the structure on a dirty metallic surface are remarkable features of MM-metal oL-steelceramic.

This technology is approved by Lloyd's Register of Shipping.



Microscope photographs / direct-MM-bonding

The following pictures show microscopic photographs of the fully cured PolymerMetal MM-metal oL-steelceramic magnified by a factor of 100 and 500. Here the bonding between MM-metal oL-steelceramic and metallic surfaces (steel or casting), which have been contaminated by various applied oils before, has been analyzed.



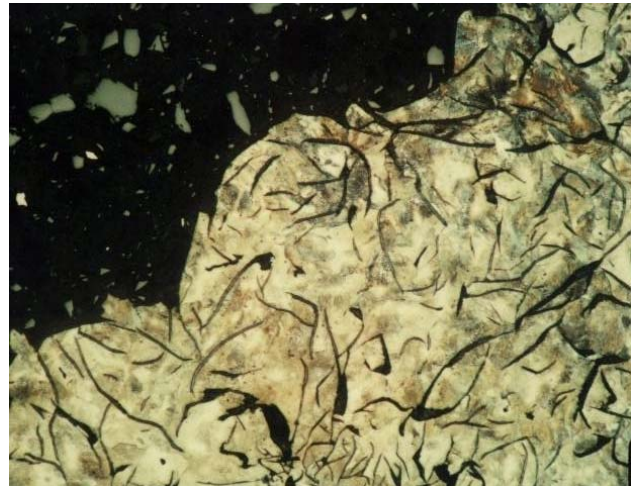
on industry gear oil / steel
(Magnification 100)



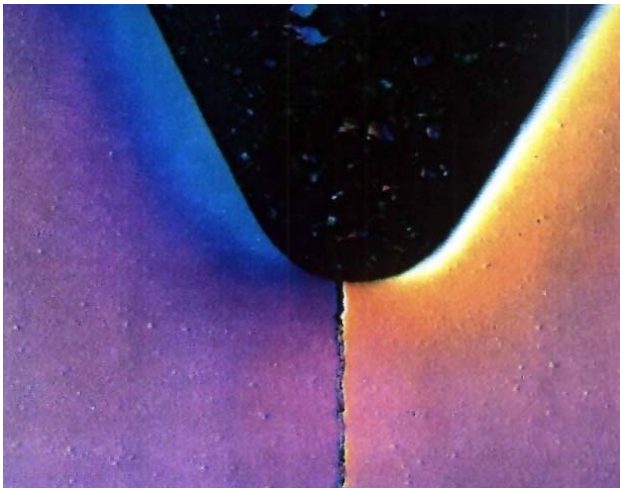
on petroleum / casting
(Magnification 100)



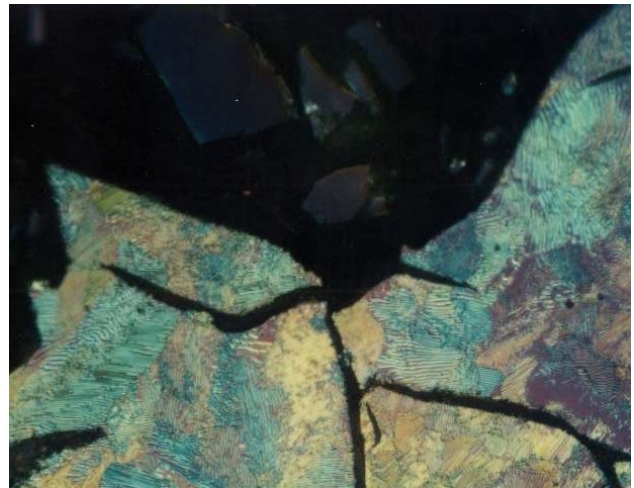
on diesel / steel
(Magnification 100)



on compression oil KSL 68 / casting
(Magnification 100)



on hydraulic oil T 29-50 / steel
(Magnification 100)

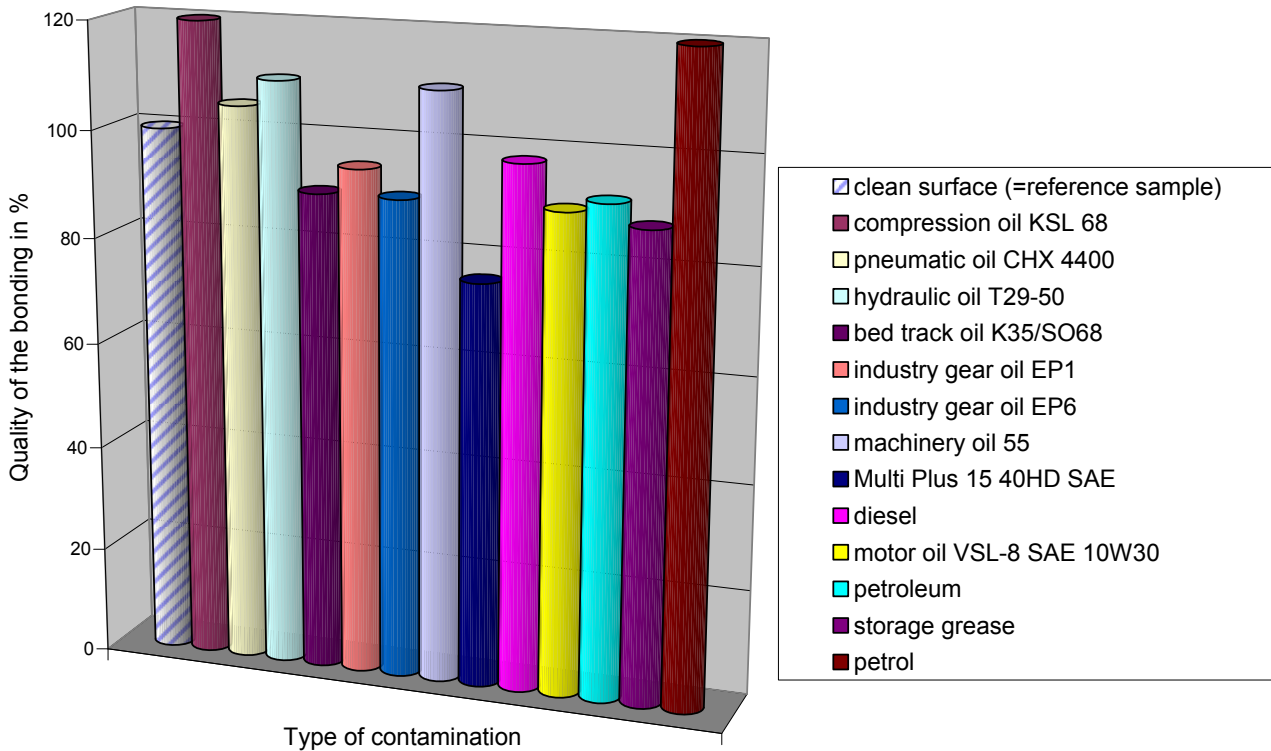


on gear oil / machine oil 55
(Magnification 500)

MM-metal oL-steelceramic penetrates and absorbs oil, grease and fuel. The direct-MM-bonding technology secures the direct and high solid bonding on contaminated surfaces.

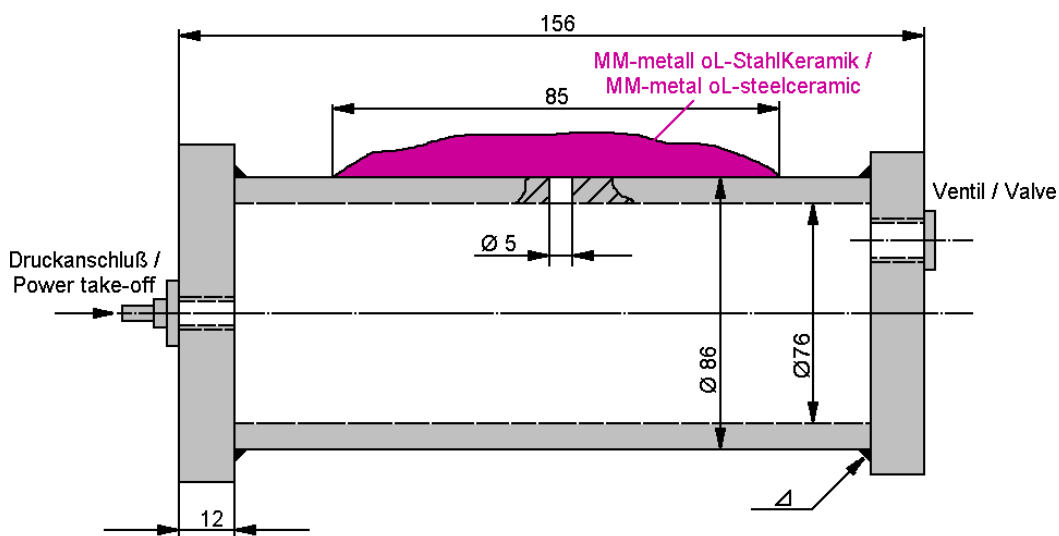
Bonding on oily surfaces

Tests have been carried out to evaluate the quality of the bonding on different surfaces. At the reference test MM-metal oL-steelceramic and Hardener yellow have been applied to a cleaned (that means oil free) and roughened metal surface. The reference value of 100% stands for the quality of the various determined technical data during bending, shearing & hydraulic tests after total curing time. Other values have been determined by applying MM-metal oL-steelceramic on different contaminated metal surfaces. The test results demonstrate that sometimes better technical values were reached after application on oily metal surfaces than on clean metal surfaces.



Testing of pressure tightness

To be able to evaluate the quality of the application of MM-metal oL-steelceramic on oily surfaces, tests have been carried out at company M.A.N. under supervision of the classification society Lloyds Register of Shipping. Here special test pipes made off steel have been created according to the following drawing. Around a leakage of a size of diameter 5 mm the metallic shiny surface (Rz 65 μm) of the test cylinder was contaminated with oil. Then the cold-curing MM-metal oL-steelceramic with Hardener yellow was applied around the leakage with a layer thickness of up to max. 8 mm. After full curing of the PolymerMetal the test cylinder has been filled with a liquid and pressure was built up. Then the system was checked against pressure tightness.



Pressure	Temperature of test cylinder	Auxiliaries	Result
100 bar	20 °C	-	pressure tight
150 bar	20 °C	-	pressure tight
200 bar	20 °C	-	after 8 hours small leakage

In the course of the time the research and development division of MultiMetall was successful to continue optimising the material MM-metal oL-steelceramic and new tests with same conditions have been carried out at MultiMetall. The following results were achieved:

Pressure	Temperature of test cylinder	Auxiliaries	Result
200 bar	20 °C	-	pressure tight
300 bar	20 °C	-	pressure tight
350 bar	20 °C	-	after 2 hours small leakage
150 bar	75 °C	pipe clip	pressure tight
400 bar	75 °C	pipe clip	pressure tight

The pipe clip was fixed around the test cylinder in the area of the leakage. Reinforcing elements as e.g. fibres or mats consisting of glass or carbon have not been used. These would have increased the physical strength essentially.

The tests have been carried out at M.A.N. (test report No. 1731/82) under supervision of Lloyds Register of Shipping (certificate No. 301954) in 1982, the test at MultiMetall in 1995.

Extract of the certificate: „The test results of MM-metal oL-steelceramic may be classed as ranging from good to exceptionally good. All test results were in support of the maker’s claim that MM-metal oL-steelceramic will bond on oily surfaces with a high degree of reliability.”

Practical example

At Weatherford pressure tests have been carried out with MM-metal oL-steelceramic. The test piece was pressure tight up to a tested pressure load of 4.000 psi (~ 275 bar).

Here are some photographs incl. test records:





Weatherford CDL 9405R1c)

Program : 1.58
 Date : 900025
 Part No. : 0
 Serial No. : 0
 Assembly : 0

Acquiring Date 21.01.2006
 Acquiring Time 11:00:03

Admin Data

Company ACOTS
 Order no. KLAUS
 Operator

Pipe Data

Pipe Type 31/2" PIPE
 Manufacturer
 Pipe Diameter
 Weight
 Grade
 Lubricant
 Comment

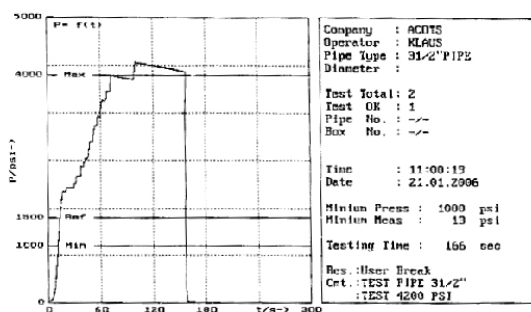
Pressure Values

Pressure Range 5000 psi
 Max. Pressure 4000 psi
 Min. Pressure 1000 psi
 Ref. Pressure 1500 psi

Sensor Data

Sensor Type
 Sensitivity (mV/V) 2.000

Weatherford CDL 9405R1c) Ver. 1.30 Date 900025



Further information can be provided upon request.

MultiMetal
 the MetalExistenceCompany®

The product information and instructions provided in this leaflet were prepared to the best of our knowledge and serve information purposes only. We recommend that appropriate tests are carried out prior to application in order to ensure that the products and methods fulfil the purpose desired by the user. In this procedure, the given data may serve as a basis. Application and processing of the products lie outside our possible control and are therefore the sole responsibility of the user.



Technical Report PolymerMetal®

TEC-# 023

Comparison compressive strength

Used products

MM-metal SS-steel 382, MM-metal SS-steel

Description

All manufacturers from polymer-metallic repair products are endeavoured to offer highest product quality. To do justice to these requirements, MultiMetall develops and produces polymer-metallic products on a high level.



The strength particularly the compressive strength describes, how much a work piece can be stressed before it breaks.

Important are the cohesion forces which hold together the smallest

parts of a work piece. As soon as the loading exceeds the cohesion forces the work piece breaks.



Based on its high user-orientated and developing potential MultiMetall does have a superior position in the area of polymer-metallic materials for years.

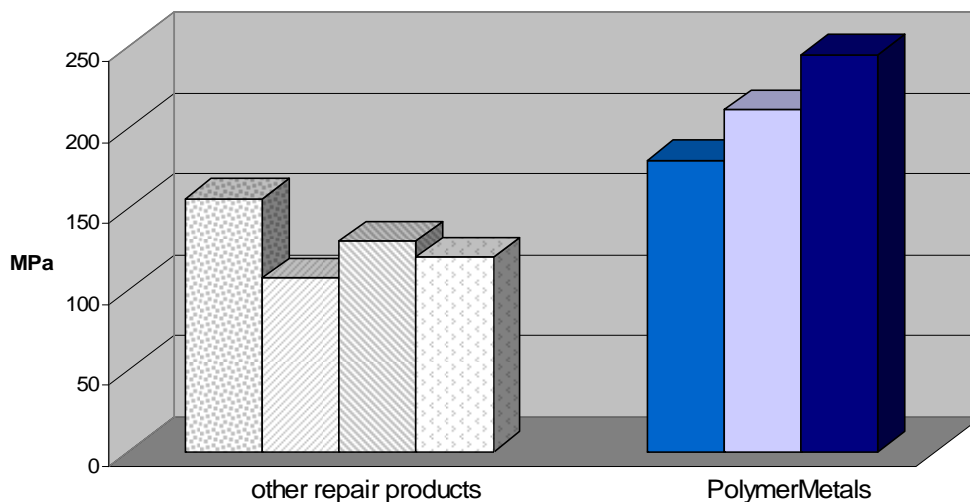


The following table compares the highest compressive strength data of polymer-metallic repair products from other producers with the data of some PolymerMetals produced by MultiMetall. The compressive strength of the MultiMetall-products has been determined by tests executed by IFAM / Germany according to DIN EN ISO 604.



Repair products from other manufacturers	MPa	PSI
Repair product A	156	22620
Repair product B	107	15515
Repair product C	130	18850
Repair product D	120	17400
PolymerMetals from MultiMetall	MPa	PSI
MM-metal SS-steel	180	26100
MM-metal SS-steel 382	211	30595
MM-metal SS-steel 382 (aftercured)	245	35525

Compressive strength



The drawing shows, that MultiMetall's PolymerMetals do without exception deliver higher data in comparison with work piece-similar products from competitors.

MultiMetall
the MetalExistenceCompany®



Worldwide repairs carried out with PolymerMetal® in the steel industry

(Photographs incl. description of each repair can be found
on our website www.polymermetal.com, „Worldwide repairs“, REP-number)

REP-#	Description
036	The contact surfaces of a supercharger have been rebuilt with MM-metal SS-steelceramic and Hardener yellow.
047	Coating of welding seams on a large transformer with MM-metal oL-steelceramic and Hardener yellow.
055	Repair of a worn-shaft-bearing for the adjustment of rolls at a 1200 ingot-blooms-rolling stand in a steel rolling mill with MM-metal SS-steelceramic. By the use of a PolymerMetal instead of a different repair method the down time was shortened from 75 to 19 hours. This is equivalent to appr. 7 working shifts. The use of the PolymerMetal MM-metal SS-steel 382, which has been developed in the meantime, would be recommended today, which offers even better compressive strength values for such types of repair. To this repair there is available an experience report upon request.
057	Repair of a corroded gas pipe due to throat gas from blast furnace carried out with Ceramium and Hardener CE.
065	Ceramium with hardener CE was used to repair cracks and damages caused by erosion between cast segments at a gas washer (Venturi) of a blast furnace cleaning facility. Due to this the life of the component was doubled.
108	Repair of worn piston rods caused by the exhausts of a blast furnace. The piston rods were brought to nominal diameter again using Ceramium. After the repair has been completed the piston rods are in operation again over 3 years.
118	Repair of the plunger of a metal bar extrusion press using MM-metal SS-steelceramic. The damage was caused by fatigue fracture. Length of the plunger 3800 mm, diameter 952 mm, weight 13 to., material: white cast iron, surface hardness 420 HB, hydraulic pressure 350 bar, operating pressure 2000 to. Procurement of a new plunger would have cost 81.000 EUR at a delivery time of appr. 9 months.
119	Repair of the anti-wear blinding, carried out in a steel mill using MM-metal SS-steelceramic and Hardener yellow.
124	Repairing a corroded and worn out pillow block bedding of a steel sheet rolling line using MM-metal SS-steelceramic. The precise pillow block seat was obtained with the help of a metal plate.
132	In a granulation plant several pumps (2 granulation pumps, 2 condense pumps, 2 cooling circuit pumps, 1 submerged pump) material loss caused by wear. All pump casings and running wheels consist of hard cast. Pumping medium is circuit water with a slag sand content of appr. 10 mg/l at a average corn size of 0,3 mm. The water temperature is 90 °C (194 °F) at the cooling circuit pumps and 40 °C (104 °F) at the condense pumps. The pumps have been repaired with a coating of Ceramium.
134	34 damaged back-up rolls bearing houses of a steel work's hot strip mill were modified. The above drawing shows a bearing shell which was damaged by turning of the outer bearing bore. Conventional repairs of these damages would have been executed by welding on, heat-treating and turning to original size. Cheaper and less time intensive is an innovative repair with MM-metal steelceramic and Hardener yellow.
135	34 damaged back-up rolls bearing houses of a steel work's hot strip mill were modified. The above drawing shows guiding plates as a fixture to the bearing house. To achieve a constant distance to the bearing at unchanged plate thickness, the surface damaged by erosion and mechanical load was restored by MM-metal steelceramic and Hardener yellow.



- 138 The worn-out shaft of a gear motor for moving an ore conveyer belt was repaired with PolymerMetal. For this the polymer material Molymetall was applied to the damaged shaft on the spot and after partial curing reduced to the desired dimension by grinding by hand with abrasive paper. The solution of the problem by using a PolymerMetal had the big advantage that through this a dismantling of the facility or shaft was not necessary. Due to this modern type of repair, the customer was able to save around 67 hours of machine shut-down.
- 140 In a steel plant the repair of a broken gearbox with a weight of 40 t would have taken up 10 days by using the conventional way of welding. By using the repair technology of MultiMetall combined with the PolymerMetal MM-metal SS-steel and MM-Release agent a repair time of just 27 hours was necessary. Stresses of 120 MPa occur at the gearbox.
- 144 A turbine paddle was worn out caused by a water-sand-mixture. The pasty variant of the PolymerMetal Ceramium was used to rebuild the worn-out areas.
- 146 At a steelwork, heavy erosion caused damage of a blast furnace. Several areas of the conveyer cone were severely damaged due to the continuous loading with coke. Some plates were welded on the cone and then coated with Ceramium as well as some other damaged parts and the machine was put into operation successfully again.
- 150 A broken pump casing was repaired with the help of the PolymerMetal MM-metal SS-steelceramic.

MultiMetall

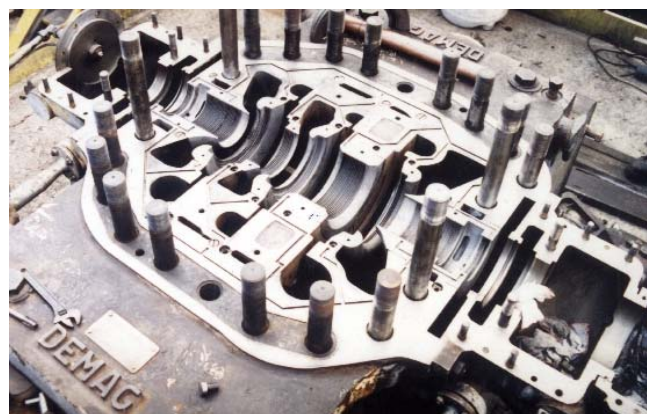
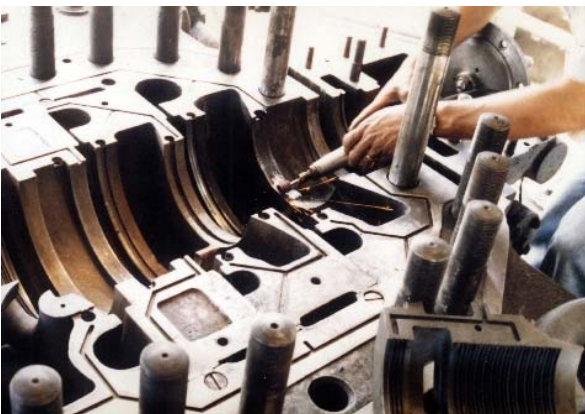
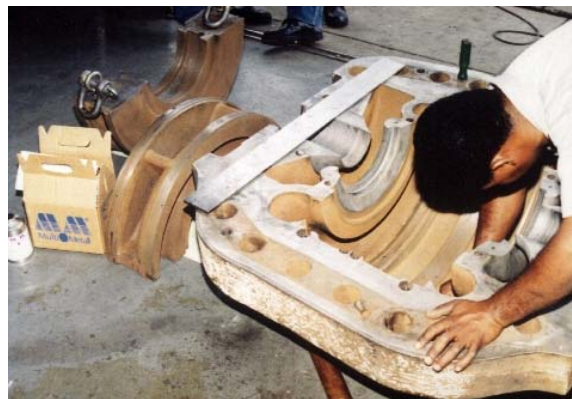
the MetalExistenceCompany®

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Worldwide repairs carried out with PolymerMetal®

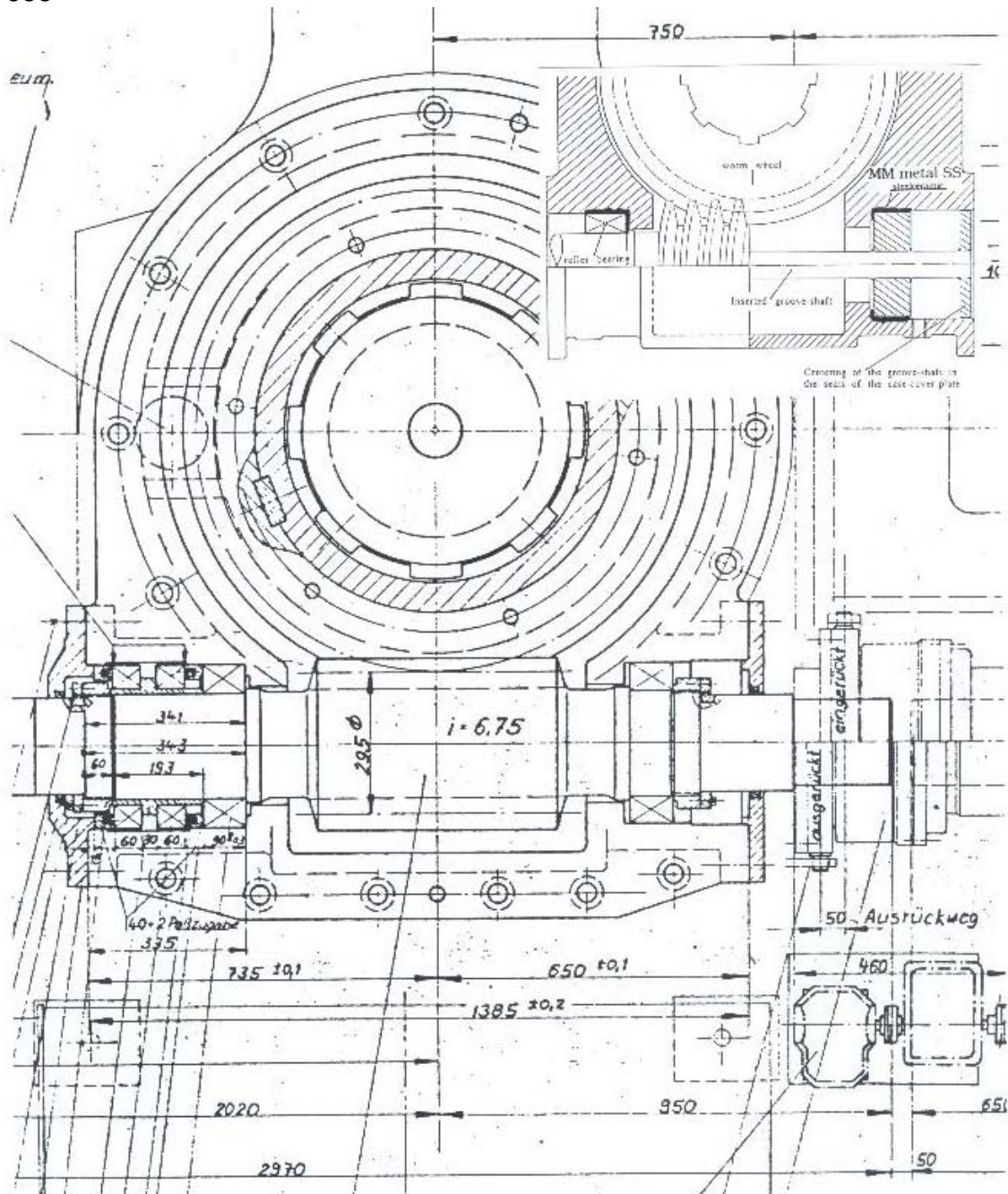
REP-# 036



The contact surfaces of a supercharger have been rebuilt with MM-metal SS-steelceramic and Hardener yellow.

MultiMetal
the MetalExistenceCompany®

REP-# 055



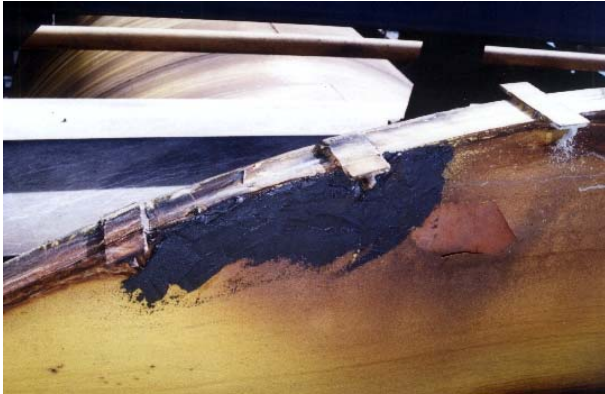
Repair of a worn-shaft-bearing for the adjustment of rolls at a 1200 ingot-blooms-rolling stand in a steel rolling mill with MM-metal SS-steelceramic. By the use of a PolymerMetal instead of a different repair method the down time was shortened from 75 to 19 hours. This is equivalent to appr. 7 working shifts. The use of the PolymerMetal MM-metal SS-steel 382, which has been developed in the meantime, would be recommended today, which offers even better compressive strength values for such types of repair. To this repair there is available an experience report upon request.

MultiMetal
the MetalExistenceCompany®



Worldwide repairs carried out with PolymerMetal®

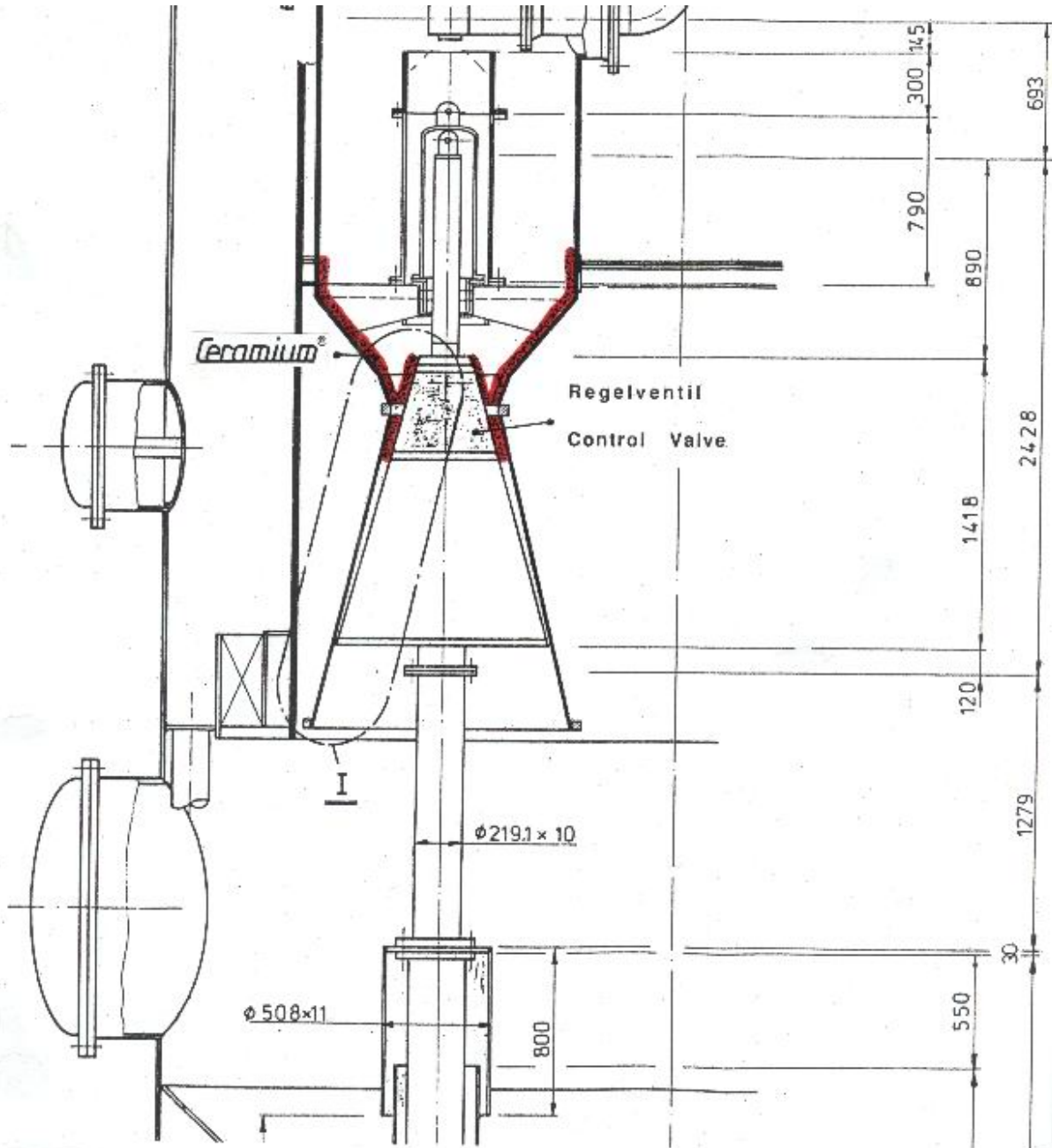
REP-# 057



Repair of a corroded gas pipe due to throat gas from blast furnace carried out with Ceramium and Hardener CE.

MultiMetal
the MetalExistenceCompany®

REP-# 065



Ceramium with hardener CE was used to repair cracks and damages caused by erosion between cast segments at a gas washer (Venturi) of a blast furnace cleaning facility. Due to this the life of the component was doubled.

MultiMetall
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Worldwide repairs carried out with PolymerMetal®

REP-# 108



Repair of worn piston rods caused by the exhausts of a blast furnace. The piston rods were brought to nominal diameter again using Ceramium. After the repair has been completed the piston rods are in operation again over 3 years.

MultiMetal
the MetalExistenceCompany®



Worldwide repairs carried out with PolymerMetal®

REP-# 118



Repair of the plunger of a metal bar extrusion press using MM-metal SS-steelceramic. The damage was caused by fatigue fracture. Length of the plunger 3800 mm, diameter 952 mm, weight 13 to., material: white cast iron, surface hardness 420 HB, hydraulic pressure 350 bar, operating pressure 2000 to. Procurement of a new plunger would have cost 81.000 EUR at a delivery time of appr. 9 months.

MultiMetal
the MetalExistenceCompany®



Worldwide repairs carried out with PolymerMetal[®]

REP-# 119



Repair of the anti-wear blinding, carried out in a steel mill using MM-metal SS-steelceramic and Hardener yellow.

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the MetalExistenceCompany[®]



Worldwide repairs carried out with PolymerMetal®

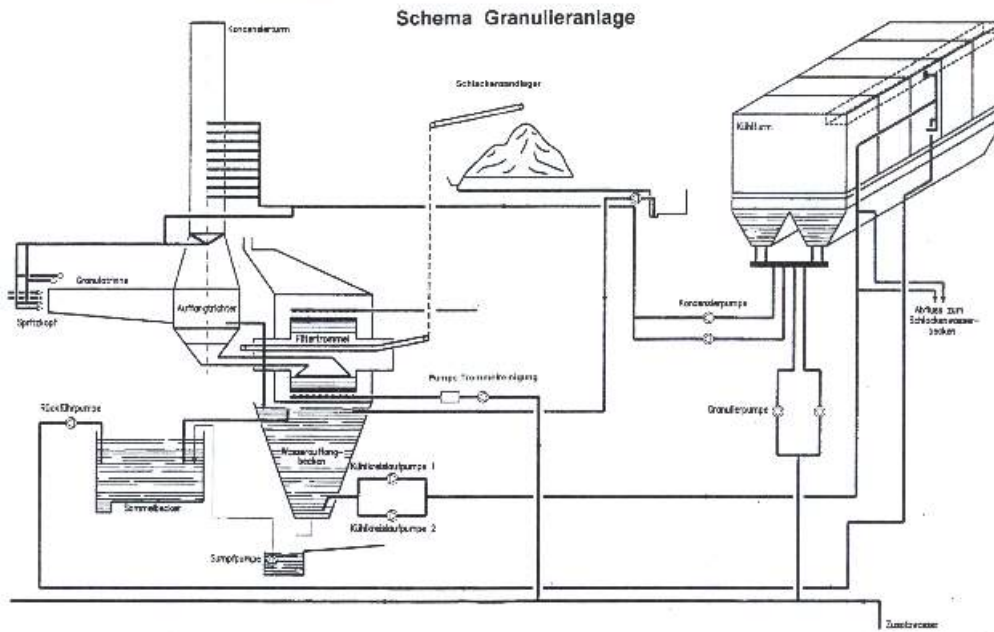
REP-# 124



Repairing a corroded and worn out pillow block bedding of a steel sheet rolling line using MM-metal SS-steelceramic. The precise pillow block seat was obtained with the help of a metal plate.

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REP-# 132



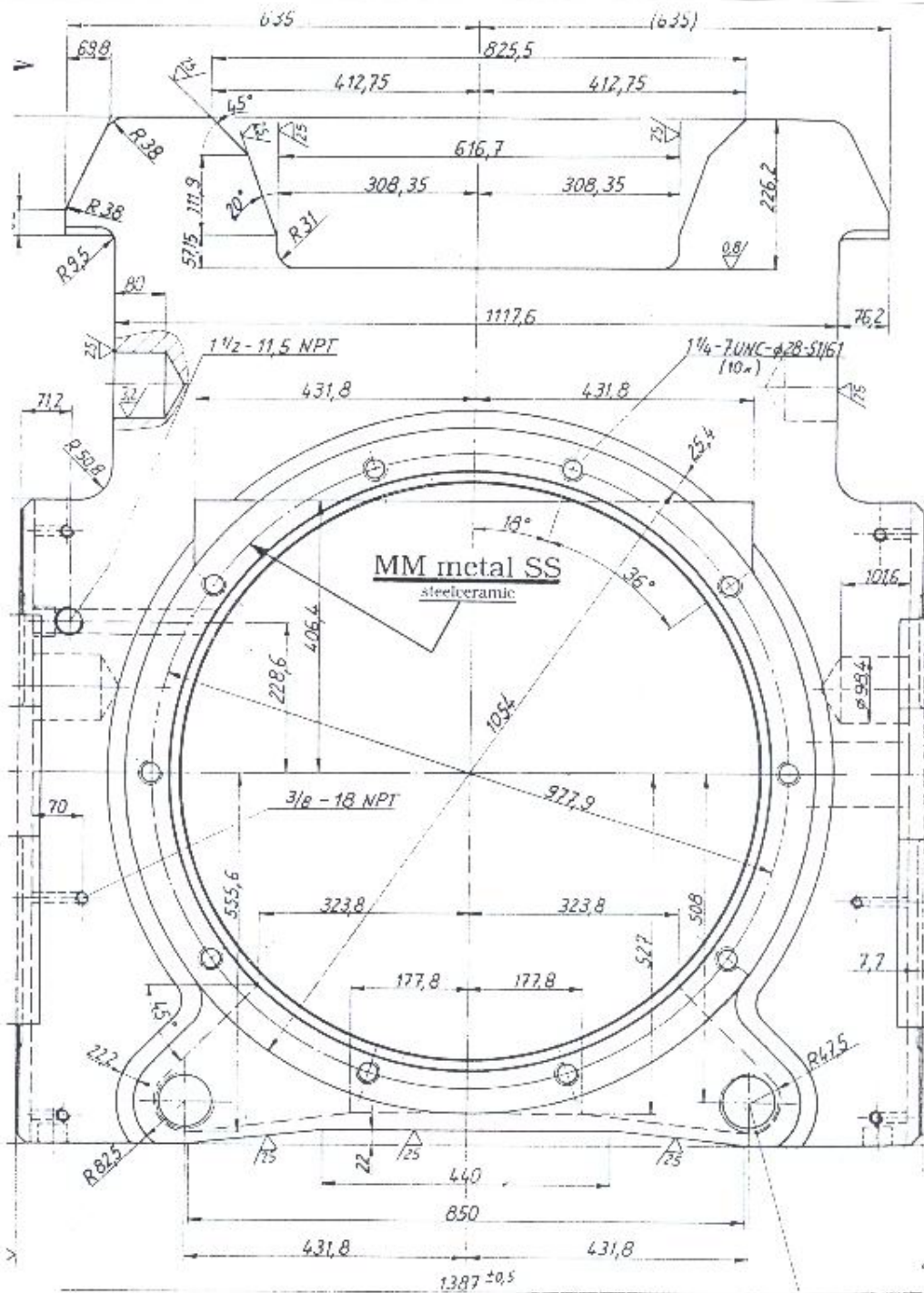
In a granulation plant several pumps (2 granulation pumps, 2 condense pumps, 2 cooling circuit pumps, 1 submerged pump) material loss caused by wear. All pump casings and running wheels consist of hard cast. Pumping medium is circuit water with a slag sand content of appr. 10 mg/l at a average corn size of 0,3 mm. The water temperature is 90 °C (194 °F) at the cooling circuit pumps and 40 °C (104 °F) at the condense pumps. The pumps have been repaired with a coating of Ceranium.

MultiMetall
the MetalExistenceCompany®



Worldwide repairs carried out with PolymerMetal®

REP-# 134



34 damaged back-up rolls bearing houses of a steel work's hot strip mill were modified. The above drawing shows a bearing shell which was damaged by turning of the outer bearing bore. Conventional repairs of these damages would have been executed by welding on, heat-treating and turning to original size. Cheaper and less time intensive is an innovative repair with MM-metal steelceramic and Hardener yellow.

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Worldwide repairs carried out with PolymerMetal®

REP-#140



In a steel plant the repair of a broken gearbox with a weight of 40 t would have taken up 10 days by using the conventional way of welding. By using the repair technology of MultiMetal combined with the PolymerMetal MM-metal SS-steel and MM-Release agent a repair time of just 27 hours was necessary. Stresses of 120 MPa occur at the gearbox.

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Worldwide repairs carried out with PolymerMetal®

REP-#144



A turbine paddle was worn out caused by a water-sand-mixture. The pasty variant of the PolymerMetal Ceramium was used to rebuild the worn-out areas.

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Worldwide repairs carried out with PolymerMetal®

REP-#146



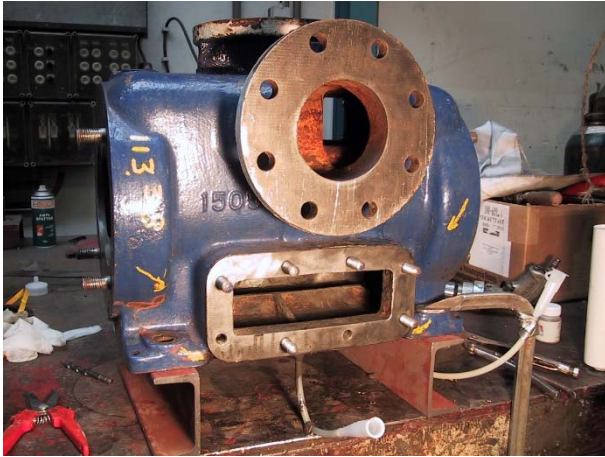
At a steelwork, heavy erosion caused damage of a blast furnace. Several areas of the conveyer cone were severely damaged due to the continuous loading with coke. Some plates were welded on the cone and then coated with Ceramium as well as some other damaged parts and the machine was put into operation successfully again.

MultiMetall
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Worldwide repairs carried out with PolymerMetal®

REP-#150



A broken pump casing was repaired with the help of the PolymerMetal MM-metal SS-steelceramic.

MultiMetal
the MetalExistenceCompany®

Produktübersicht / Product Overview

Prod-#	Produkt (Deutsch / German)	Product (Englisch / English)	Einheit/Unit	Notizen/Notes
	MM-metall SS-StahlKeramik	MM-metal SS-steelceramic		
200	MM-metall SS-StahlKeramik, pst.	MM-metal SS-steelceramic, pst.	1000 g	
249	Härter gelb, pst.	Hardener yellow, pst.	50 g	
248	Härter rot, pst.	Hardener red, pst.	100 g	
	MM-metall SQ	MM-metal SQ		
300	MM-metall SQ, pul.	MM-metal SQ, pow.	1000 g	
301	Härter SQ2, fl.	Hardener SQ2, liq.	220 g	
302	Härter SQ8, fl.	Hardener SQ8, liq.	220 g	
	MM-metall SS-Stahl 382	MM-metal SS-steel 382		
217	MM-metall SS-Stahl 382, pst.	MM-metal SS-steel 382, pst.	1000 g	
249	Härter gelb, pst.	Hardener yellow, pst.	50 g	
218	MM-metall SS-Stahl 382, fl.	MM-metal SS-steel 382, liq.	1000 g	
250	Härter gelb, fl.	Hardener yellow, liq.	50 g	
	MM-metall SS, pastöse Konsistenz	MM-metal SS, pasty consistency		
201	MM-metall SS-Stahl, pst.	MM-metal SS-steel, pst.	1000 g	
205	MM-metall SS-Aluminium, pst.	MM-metal SS-aluminium, pst.	600 g	
209	MM-metall SS-Kupfer, pst.	MM-metal SS-copper, pst.	1000 g	
211	MM-metall SS-Bronze, pst.	MM-metal SS-bronze, pst.	1000 g	
249	Härter gelb, pst.	Hardener yellow, pst.	50 g	
	MM-metall SS, flüssige Konsistenz	MM-metal SS, liquid consistency		
202	MM-metall SS-Stahl, fl.	MM-metal SS-steel, liq.	1000 g	
206	MM-metall SS-Aluminium, fl.	MM-metal SS-aluminium, liq.	600 g	
210	MM-metall SS-Kupfer, fl.	MM-metal SS-copper, liq.	1000 g	
212	MM-metall SS-Bronze, fl.	MM-metal SS-bronze, liq.	1000 g	
250	Härter gelb, fl.	Hardener yellow, liq.	50 g	
	MM-metall oL-StahlKeramik	MM-metal oL-steelceramic		
2460	MM-metall oL-StahlKeramik, pst.	MM-metal oL-steelceramic, pst.	1000 g	
249	Härter gelb, pst.	Hardener yellow, pst.	50 g	
248	Härter rot, pst.	Hardener red, pst.	100 g	
246	MM-metall oL-StahlKeramik, pst.	MM-metal oL-steelceramic, pst.	500 g	
253	Härter gelb, pst.	Hardener yellow, pst.	25 g	
248	Härter rot, pst.	Hardener red, pst.	100 g	
	MM-metall UW	MM-metal UW		
1160	MM-metall UW, pul.	MM-metal UW, pow.	1000 g	
1170	Härter UW3, fl.	Hardener UW3, liq.	250 g	
1180	Härter UW9, fl.	Hardener UW9, liq.	250 g	
116	MM-metall UW, pul.	MM-metal UW, pow.	500 g	
117	Härter UW3, fl.	Hardener UW3, liq.	125 g	
118	Härter UW9, fl.	Hardener UW9, liq.	125 g	
	Ceramium®	Ceramium®		
601	Ceramium, pst.	Ceramium, pst.	695 g	
611	Härter CE, pst.	Hardener CE, pst.	55 g	
602	Ceramium, fl.	Ceramium, liq.	695 g	
607	Härter CE, fl.	Hardener CE, liq.	55 g	
	Ceramium® CH	Ceramium® CH		
622	Ceramium CH, pst.	Ceramium CH, pst.	1000 g	
623	Härter CH1, pst.	Hardener CH1, pst.	75 g	
624	Härter CH1, fl.	Hardener CH1, liq.	65 g	
625	Härter CH2, pst.	Hardener CH2, pst.	80 g	
626	Härter CH2, fl.	Hardener CH2, liq.	70 g	
	XETEX® BD	XETEX® BD		
455	XETEX BD, pst.	XETEX BD, pst.	750 g	
456	Härter BD, fl.	Hardener BD, liq.	50 g	

Produktübersicht / Product Overview

Prod-#	Produkt (Deutsch / German)	Product (Englisch / English)	Einheit/Unit	Notizen/Notes
	VP 10-017	VP 10-017		
705	VP 10-017, fl.	VP 10-017, liq.	800 g	
706	Härter VP 10-017 rot, fl.	Hardener VP 10-017 red, liq.	400 g	
707	Härter VP 10-017 grau, fl.	Hardener VP 10-017 grey, liq.	400 g	
	VP 10-500	VP 10-500		
701	VP 10-500, pst.	VP 10-500, pst.	650 g	
711	Härter VP 10-500, pst.	Hardener VP 10-500, pst.	650 g	
702	VP 10-500, str.	VP 10-500, br.	650 g	
712	Härter VP 10-500, str.	Hardener VP 10-500, br.	650 g	
	Molymetall®	Molymetall®		
401	Molymetall, pst.	Molymetall, pst.	800 g	
403	Härter Molymetall, pst.	Hardener Molymetall, pst.	30 g	
404	Härter Molymetall, fl.	Hardener Molymetall, liq.	30 g	
	Sealium®	Sealium®		
551	Sealium, fl.	Sealium, liq.	2000 ml	
	MM-metall S	MM-metal S		
101	MM-metall S-Stahl, pul.	MM-metal S-steel, pow.	1000 g	
102	MM-metall S-Eisen, pul.	MM-metal S-iron, pow.	1000 g	
105	MM-metall S-Aluminium, pul.	MM-metal S-aluminium, pow.	650 g	
108	MM-metall S-Kupfer, pul.	MM-metal S-copper, pow.	1650 g	
109	MM-metall S-Bronze, pul.	MM-metal S-bronze, pow.	1650 g	
147	Härter S8, fl.	Hardener S8, liq.	250 g	
148	Härter S15, fl.	Hardener S15, liq.	250 g	
	MM-Elastomer	MM-Elastomer		
951	MM-Elastomer 95, pst.	MM-Elastomer 95, pst.	370 g	
952	MM-Elastomer 95, fl.	MM-Elastomer 95, liq.	370 g	
953	MM-Elastomer 95, str.	MM-Elastomer 95, br.	370 g	
962	Härter EL95, fl.	Hardener EL95, liq.	110 g	
956	MM-Elastomer 85, fl.	MM-Elastomer 85, liq.	370 g	
964	Härter EL85, fl.	Hardener EL85, liq.	110 g	
958	MM-Elastomer 65, fl.	MM-Elastomer 65, liq.	370 g	
966	Härter EL65, fl.	Hardener EL65, liq.	74 g	
960	MM-Elastomer 40, fl.	MM-Elastomer 40, liq.	370 g	
968	Härter EL40, fl.	Hardener EL40, liq.	89 g	
	MM-Sets	MM-Sets		
802	MM-Basic Set	MM-Basic Set	Stück / pc	
803	MM-Set SS	MM-Set SS	Stück / pc	
804	MM-Set oL	MM-Set oL	Stück / pc	
805	MM-Set UW	MM-Set UW	Stück / pc	
806	MM-Set VP 10-500	MM-Set VP 10-500	Stück / pc	
	Zubehör	Accessories		
10	MM-Lösung Z, fl.	MM-Degreaser Z, liq.	1000 ml	
11	MM-Lösung Z, fl.	MM-Degreaser Z, liq.	250 ml	
14	MM-Trennmittel, fl.	MM-Release agent, liq.	100 ml	
33	Mischplatte (Kunststoff)	Mixing plate (synthetic material)	20 x 12 cm	
16	Mischstab (rostfreier Stahl)	Mixing stick (stainless steel)	Stück / pc	
15	Mischbecher (Kunststoff)	Mixing cup (synthetic material)	Stück / pc	
25	Messlöffel rot	Measuring spoon red	Satz / set	
26	Messlöffel gelb	Measuring spoon yellow	Satz / set	
29	Messlöffel VP 10-500	Measuring spoon VP 10-500	Satz / set	
18	Gewebeband (rostfreier Stahl)	Fabric tape (stainless steel)	100 x 10 cm	
20	Gewebeband (Glasfaser)	Fabric tape (glass fibre)	1000 x 5 cm	
22	Gewebematte (Glasfaser)	Fabric mat (glass fibre)	30 x 40 cm	
23	Applikationsroller	Application roller	Stück / pc	
34	Temperaturindikator (Einweg)	Temperature indicator (one-way)	15 Stück / pc	

Hinweise / Notes:

Konsistenz/consistency: pst./pst.=pastös/pasty; fl./liq.=flüssig/liquid; pul./pow.=pulvrig/powdery; str./br.=streichbar/brushable

EXW = Lieferung ab Lager Deutschland excl. Verpackung / delivery ex works stock Germany excl. packing

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Fax: +49 - (0) 21 62-97 00 9-11
Email: info@polymermetal.com
Web: www.polymermetal.com

Version (20.11.2013)

In order to find out which PolymerMetall® could be used to solve your repair problem we would like to ask you to fill in and send back this form. Additional sketches, drawings, photographs etc. could be helpful. We thank you for your effort!

Description of the device

Machine/Plant/Construction:

Damaged device (Name):

Function:

Material of the device:

Relevant dimensions (e.g. length, width, height, diameter, wall thickness...):
of the device:

of the damaged area:

Damage description (e.g. crack, wear, leakage,... – in detail please):
.....
.....
.....

Reason and cause of damage (Why?... Whereby?... – in detail please):
.....
.....

Constructive weakening (structural/mechanical strength) of the device due to damage
 No | Yes

Notes/Other:

Influences on the repair area at operating conditions







Thermal stress
min °C | max °C | Durable Ø °C

Mechanical stress
 No | Yes MPa | Yes

Pressure load by fluids
 No | Yes bar | Yes.....

Chemical stress
 No | Yes Chemical(s) (if so with concentration data) Chemical temperature
..... °C
..... °C
..... °C

Tribological stress

<input type="checkbox"/> No <input type="checkbox"/> Yes		Sliding wear (Adhesion)	<input type="checkbox"/> Yes		Impact particle wear (Abrasion)
<input type="checkbox"/> Yes		Sliding abrasion (Abrasion)	<input type="checkbox"/> Yes		Drop erosion wear (Surface fatigue)
<input type="checkbox"/> Yes		Particle erosion – fluids (Erosion, Abrasion)	<input type="checkbox"/> Yes		Cavitation wear (Surface fatigue)



Influences on the repair area during the repair

Location of the device, plant, construction

Indoor (e.g. building, hall ...)

Outdoor;

Protection against climatic influence possible Yes | No

Device temperature

..... °C

Repair surface of the device, plant, construction

oily or greasy | contaminated with petrols | wet (water) or under water

dry (or can be made free of any oil, grease, petrol, water etc. for the duration of the application)

roughening possible prior to the application of repair material

.....

Remaining pressure in system

No, for the period of the repair & curing pressureless system possible

Yes; bar

Machining (chipping) necessary / required after repair or curing

No | Yes

Other

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Appendix: Sketches Technical drawing Photographs Test report/Journal
 Other:

Sender

Company:
Address:
Contact person:
Phone / Fax:
Email:

MultiMetall
the MetalExistenceCompany®