

**DR. FRITSCH**

POWDER SHAPING TECHNOLOGIES

# DSP 515

SINTER PRESS



**FAST DIRECT-HOT PRESSING (DHP) BY DR. FRITSCH**  
**FAST ◦ PRECISE ◦ ECONOMICAL**

**FAST DIRECT-HOT PRESSING (DHP)** is a technology with many advantages compared to conventional sintering techniques:

**FAST** (Field Assisted Sintering Technique)

DHP does not heat up the sinter chamber but the sinter part or the mould directly. Very short sinter cycles are achieved by that. This technique is suitable for electrically conductive as well as for non-conductive materials. Depending on the material and size of the specimen, a sinter cycle takes usually between several minutes and 1,5 hours.

**PRECISE**

All sinter parameters can be controlled exactly. A process monitoring software shows all information and administers the process data. Sinter programs can be adjusted to your individual requirements. Near net-shape production is a must, especially when working with precious materials. Thanks to the precise control of all parameters like pressure, temperature, travel distance and time, it is nothing to worry about.

**ECONOMICAL**

DHP is ideal for both, research and development and mass production. Different machine sizes suit to individual needs. Operation is easy and most machines are fully automated and can be integrated in an automated production environment.

**SINTER PROCESS**

The filled die is put into the machine manually or automatically, depending on the machine configuration. The sinter program is initiated by one click. The typical sinter programme consists of 3 steps:

- a) De-waxing with vapour extraction under vacuum and inert gas flow
- b) Sintering under vacuum with inert gas flow
- c) Cooling under vacuum with inert gas flow

Heating velocity, sinter temperature, pressure and time can be set individually and can be adjusted to your materials.

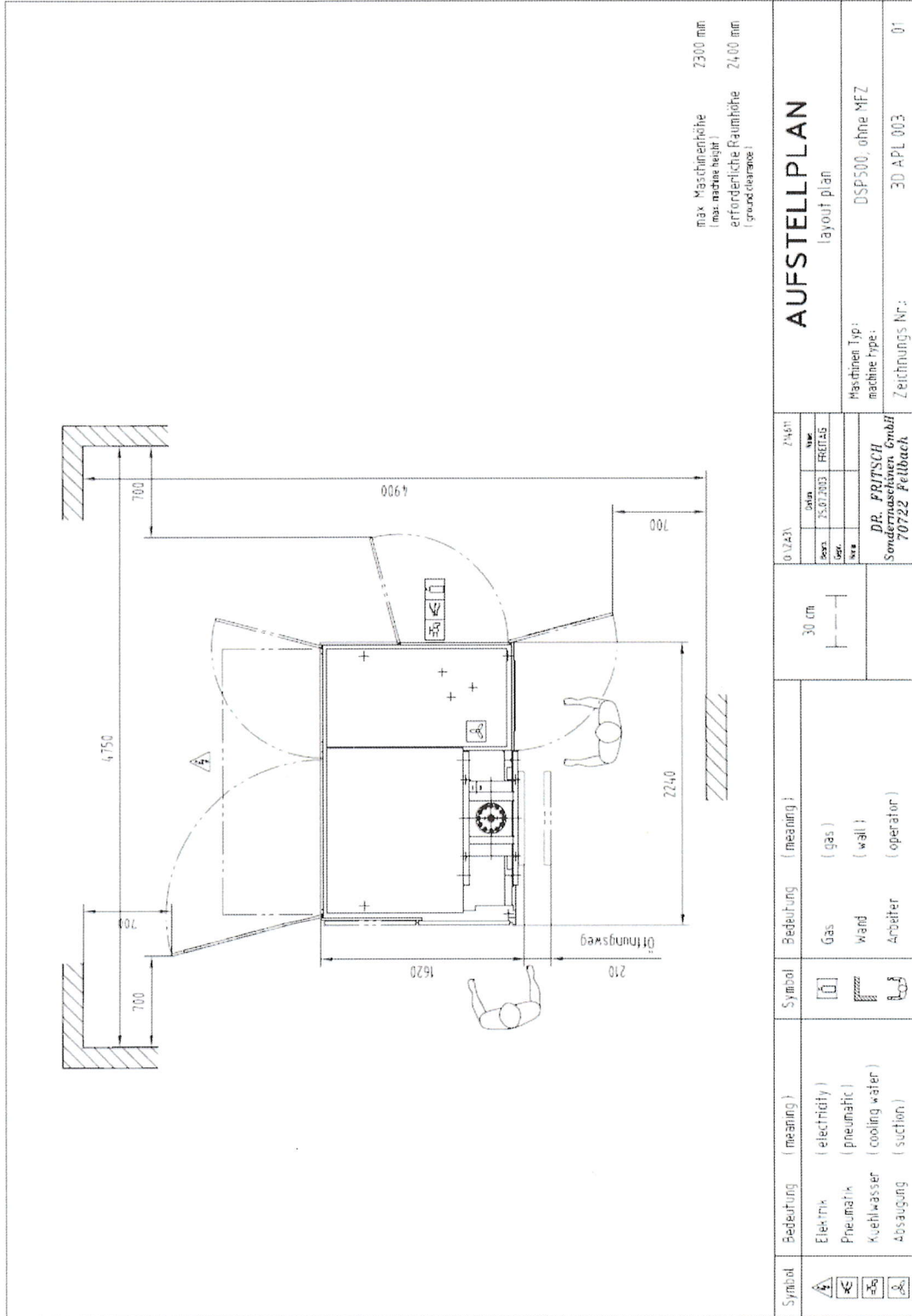
After the sinter program has been completed the die is unloaded manually or automatically and a new die is put into sinter position.

**TECHNICAL DATA****DSP 515**

Electric power	approx. 180 kVA, max. heating power 170 kVA
Supply voltage	3 x 400 Volt, 50/60 cps (other voltages upon request)
Nominal current at 400 Volt	3 x 355 A
Fuses (to be provided by the customer)	3 x 400 A
Cooling water:	
- pressure:	2 – 4 bar
- consumption:	approx. 120 - 150 l/min
- temperature:	15 – 25 °C
- connections:	Supply: 1,5" inside thread; Discharge: 2" inside thread
Compressed air:	4-6 bar, approx. 20 l/min
Inert gas:	
- consumption:	approx. 20-100 l/h (depending on process)
- pressure:	1 - 5bar
Suction:	to be provided by the customer
- connection:	connecting piece Ø 100 mm
- recommended air flow:	800 m <sup>3</sup> /h
Vacuum:	20mbar (standard) 0,05mbar (optional)
Graphite electrodes	
- dimensions (LxDxH)	180 x 180 x 60mm or 220 x 220 x60mm
- opening width	approx. 145 mm
Pressing force	
- pressure range	50,3 kN – 603,2 kN
Special cylinder with two pressure ranges (option):	
- lower pressure range	7,1 kN - 71,3 kN
- higher pressure range	50,3 kN – 603,2 kN
In case of pyroscope measurement through hydraulic cylinder:	46,3 kN – 555,5 kN
Temperature measuring:	thermocouple Ni-Cr-Ni (100 – 1100 °C) optional pyroscope (up to 2.400 °C)
Positional transducer:	Electronic, accuracy 0,1mm; Resolution 0,005mm
Dimensions (approx):	
- Length:	2240 mm
- Width:	1620 mm
- Height:	2300 mm
Weight:	approx. 3800 kg

- Technical data and design are subject to modifications -

## FLOOR PLAN



This is a general product information. All information provided is subject to change anytime without prior notice.  
Only the data mentioned in the quotation and order confirmation or similar documents is binding.

We will be pleased to send you a quotation and answer your questions.

**CONTACT**

Dr. Fritsch Sondermaschinen GmbH  
Powder Shaping Technologies  
Dieselstr. 8

D-70736 Fellbach

Germany

Phone. +49-(0)711-51832-0  
Fax +49-(0)711-51832-10

pst@dr-fritsch.de  
www.directhotpressing.com



# PŘÍLOHA II.

## Specification

## Dr. Fritsch GmbH & Co. KG

Dieselstarsse 8  
D-70736 Fellbach  
Telephone: ++49-711-51832-0  
Fax: ++49-711-51832-159  
[http. //www.dr-fritsch.de](http://www.dr-fritsch.de)  
E-mail: powder@dr-fritsch.de

Datum/Date: 07.01.2013

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Kunde / Customer:

Produkt / Product:

Diabro-901040

Ihr Bestell-Datum / Your Order No Dated:

Unsere Auftrags-Nr. / Our Order No.:

Liefermenge / Quantity Delivered:

F.N.-Nr.: / F.N-No.:

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### Analysenergebnisse / Analytical Results:

#### Siebanalyse / Sieving Analysis:

> 80 µm	max. 0,2 %
> 63 µm	max. 1 %
> 40 µm	max. 5 %
< 40 µm	balance by weight

#### Füllichte / Apparent Density:

3,2 - 4,0 g/cm<sup>3</sup>

#### Chemische Analyse / Chemical Analysis:

Sn	9 - 11 %
O	

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### Bemerkungen / Remarks:

Dr. Fritsch GmbH & Co. KG

# SINTERING - DATA - SHEET

DR. FRITSCH GmbH & Co. KG

Dieselstraße 8

70736 Fellbach

Tel. 0711-518320; Fax 0711-5183210

**powder - code:** Diabro-901040

<b>main component:</b>	Bz	<b>binder:</b>		<b>date:</b>	06.09.2011
<b>machine type:</b>	DSP-25	<b>aver. Grain size</b>		<b>testperson:</b>	OE
<b>utilisation:</b>					

<b>heating by</b>	<b>die:</b>	X	<b>temperature measurement by:</b>	<b>pyroscope:</b>	
	<b>punches:</b>			<b>thermocouple:</b>	X

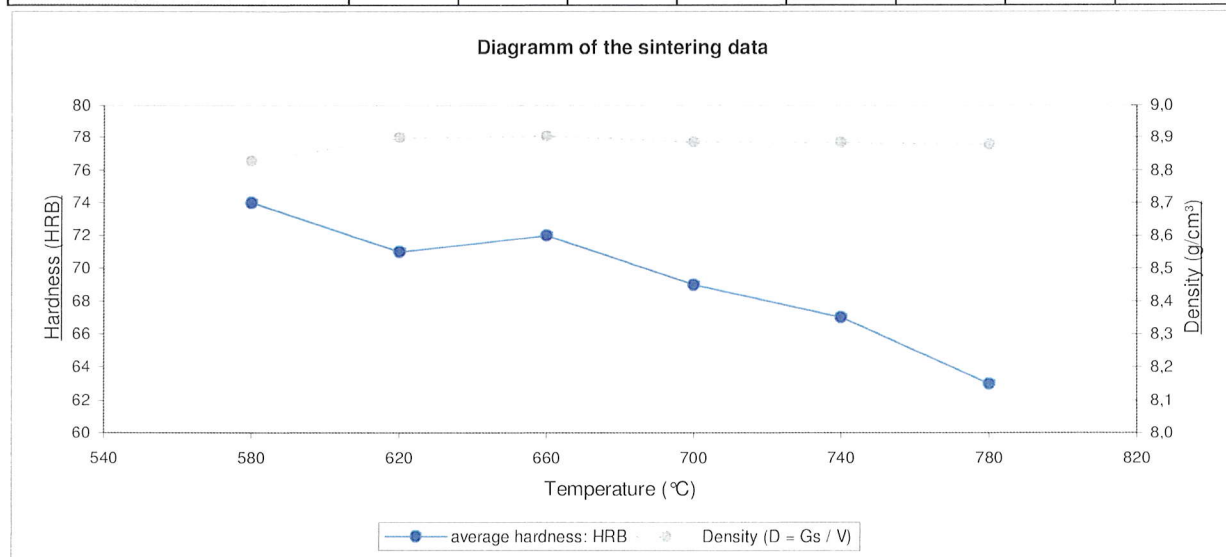
<b>temperature:</b>	$^{\circ}\text{C}$	580	620	660	700	740	780		
<b>specific pressure:</b>	$\text{N/mm}^2$	35	==>						
<b>sintering time:</b>	$\text{min}$	3	==>						

<b>bending strength:</b>	$\text{N/mm}^2$								
<b>stretch at break:</b>	%								
<b>average hardness:</b>	HRB	74	71	72	69	67	63		
<b>hardness scattering:</b>	HRB	72-75	70-72	71-73	68-70	66-68	63-65		
<b>average hardness:</b>	HRC								
<b>hardness scattering:</b>	HRC								
<b>weight:</b>	g	17	==>						
<b>weight after sintering:</b>	g								

<b>Volume</b> ( $V = G_s - G_w$ )	$\text{cm}^3$								
<b>Density</b> ( $D = G_s / V$ )	$\text{g/cm}^3$	8,83	8,90	8,90	8,89	8,88	8,88		

<b>weight loss</b> ( $G = G_e - G_s$ )	$\text{g}$								
<b>rel. Weight loss</b> ( $G_r = G * 100$ )	%								

**notes:**



**Attention:**

Depending on mould-geometry and type and place of temperature-measurement an increase up to 60 °C must be done to get the same result !  
 In case of moulds with a high number of graphite punches a certain friction value needs to be considered. To obtain the detailed formula you are welcome to contact us.

Property of Dr. Fritsch GmbH & Co.KG. Transmission only allowed in explicit agreement with the management.



# PŘÍLOHA III.

## Specification

## Dr. Fritsch GmbH & Co. KG

Dieselstarsse 8  
D-70736 Fellbach  
Telephone: ++49-711-51832-0  
Fax: ++49-711-51832-159  
[http. //www.dr-fritsch.de](http://www.dr-fritsch.de)  
E-mail: powder@dr-fritsch.de

Datum/Date: 24.01.2012

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Kunde / Customer:

Produkt / Product:

Diabro-851540

Ihr Bestell-Datum / Your Order No Dated:

Unsere Auftrags-Nr. / Our Order No.:

Liefermenge / Quantity Delivered:

F.N.-Nr.: / F.N-No.:

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### Analysenergebnisse / Analytical Results:

#### Siebanalyse / Sieving Analysis:

> 80 µm	max. 0,2 %
> 63 µm	max. 1 %
> 40 µm	max. 5 %
< 40 µm	> 95 % by weight

#### Füllichte / Apparent Density:

3,1 - 3,9 g/cm<sup>3</sup>

#### Chemische Analyse / Chemeical Analysis:

Sn	14 - 16 %
Zn	max. 1 %
Hydrogen Loss	max. 0,2 %

Pre-alloyed Copper - Tin - Alloy with app. 15 % Tin content

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### Bemerkungen / Remarks:

Dr. Fritsch GmbH & Co. KG

# SINTERING-DATA-SHEET

DR. FRITSCH GmbH & Co. KG

Dieselstraße 8

70736 Fellbach

Tel. 0711-518320; Fax 0711-5183210

<b>powder - code:</b>	DIABRO-851540
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<b>main component:</b>	Bz	<b>binder:</b>	2% alcohol	<b>date:</b>	16.03.98
<b>machine type:</b>	DSP-25	<b>aver. Grain size</b>		<b>testperson:</b>	Ga
<b>utilisation:</b>					

<b>heating by</b>	<b>die:</b>	X	<b>temperature measure-</b>	<b>pyroscope:</b>	
	<b>punches:</b>		<b>ment by:</b>	<b>thermocouple:</b>	X

	°C	500	540	580	620	660	700	740	780
<b>temperature:</b>									
<b>specific pressure:</b>	<i>N/mm<sup>2</sup></i>	25	==>						
<b>machine pressure:</b>	<i>bar</i>	40	==>						
<b>sintering time:</b>	<i>min</i>	3	==>						
<b>bending strength:</b>	<i>N/mm<sup>2</sup></i>								
<b>stretch at break:</b>	<i>%</i>								
<b>average hardness:</b>	HRB	91	89	87	86				
<b>hardness scattering:</b>	HRB	90-92	89-90	86-88	85-86				
<b>weight:</b>	<i>g</i>	17	==>						
<b>weight after sintering:</b>	<i>g</i>	16.844	16.585	16.926	16.834				

<b>volume:</b>									
$V = G_s - G_w$	<i>cm<sup>3</sup></i>	1.903	1.865	1.9	1.898				
<b>density:</b>									
$D = G_s / V$	<i>g/cm<sup>3</sup></i>	8.85	8.89	8.91	8.91				

<b>weight loss:</b>									
$G = G_e - G_s$	<i>g</i>								
<b>rel. Weight loss:</b>									
$Gr = G * 100 / G_e$	<i>%</i>								

<b>notes:</b>	
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**Attention:**

Depending on mould-geometry and type and place of temperature-measurement an increase up to 60 °C must be done to get the same result !

Property of Dr. Fritsch KG. Transmission only allowed in explicit agreement with the management.

# PŘÍLOHA IV.

## Specification

## Dr. Fritsch GmbH & Co. KG

Dieselstarsse 8  
D-70736 Fellbach  
Telephone: ++49-711-51832-0  
Fax: ++49-711-51832-159  
[http. //www.dr-fritsch.de](http://www.dr-fritsch.de)  
E-mail: powder@dr-fritsch.de

Datum/Date: 19.03.2015

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Kunde / Customer:

Produkt / Product:

Diabro-802040

Ihr Bestell-Datum / Your Order No Dated:

Unsere Auftrags-Nr. / Our Order No.:

Liefermenge / Quantity Delivered:

F.N.-Nr.: / F.N-No.:

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### Analysenergebnisse / Analytical Results:

#### Siebanalyse / Sieving Analysis:

> 100 µm	
> 80 µm	< 0,2%
> 63 µm	< 1 %
> 40 µm	< 5 %
< 40 µm	> 95 % by weight

#### Füllichte / Apparent Density:

3,2 - 3,8 g/cm<sup>3</sup>

#### Chemische Analyse / Chemical Analysis:

Sn	19 - 21 %
Zn	max. 1 %
O:	max. 0,2 %

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### Bemerkungen / Remarks:

Dr. Fritsch GmbH & Co. KG

# S I N T E R I N G - D A T A - S H E E T

DR. FRITSCH GmbH & Co. KG

Dieselstraße 8

70736 Fellbach

Tel. 0711-518320; Fax 0711-5183210

<b>powder - code:</b>	Diabro 802040
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<b>main component:</b>	Cu	<b>binder:</b>	2% alcohol	<b>date:</b>	09.02.98
<b>machine type:</b>	DSP-25	<b>aver. Grain size</b>	<40 µm	<b>testperson:</b>	Ga
<b>utilisation:</b>					

<b>heating by</b>	<b>die:</b>	X	<b>temperature measure-</b>	<b>pyroscope:</b>	
	<b>punches:</b>		<b>ment by:</b>	<b>thermocouple:</b>	X

<b>temperature:</b>	°C	460	500	540	580	620	660	700	
<b>specific pressure:</b>	<i>N/mm²</i>	20	==>						
<b>machine pressure:</b>	<i>bar</i>	40	==>						
<b>sintering time:</b>	<i>min</i>	3	==>						
<b>bending strength:</b>	<i>N/mm²</i>								
<b>stretch at break:</b>	<i>%</i>								
<b>average hardness:</b>	HRB	94	99	99	99	97	97	97	
<b>hardness scattering:</b>	HRB	93-95	98-100	98-99	97-99	96-98	97-98	97-98	
<b>weight:</b>	<i>g</i>	17	==>						
<b>weight after sintering:</b>	<i>g</i>	16,84	16,845	16,203	16,396	16,681	16,757	16,822	

<b>volume:</b>									
<b>V = G<sub>s</sub> - G<sub>w</sub></b>	<i>cm³</i>	1,96	1,918	1,816	1,839	1,87	1,88	1,886	
<b>density:</b>									
<b>D = G<sub>s</sub> / V</b>	<i>g/cm³</i>	8,59	8,78	8,91	8,92	8,92	8,92	8,92	

<b>weight loss:</b>									
<b>G = G<sub>e</sub> - G<sub>s</sub></b>	<i>g</i>								
<b>rel. Weight loss:</b>									
<b>Gr = G * 100 / G<sub>e</sub></b>	<i>%</i>								

<b>notes:</b>	
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**Attention:**

Depending on mould-geometry and type and place of temperature-measurement an increase up to 60 °C must be done to get the same result !

Property of Dr. Fritsch KG. Transmission only allowed in explicit agreement with the management.

# PŘÍLOHA V.

## Specification

## Dr. Fritsch GmbH & Co. KG

Dieselstarsse 8  
D-70736 Fellbach  
Telephone: ++49-711-51832-0  
Fax: ++49-711-51832-159  
[http. //www.dr-fritsch.de](http://www.dr-fritsch.de)  
E-mail: powder@dr-fritsch.de

Datum/Date: 27.02.2017

Kunde / Customer:

Produkt / Product:

Dialloy-8000

Ihr Bestell-Datum / Your Order No Dated:

Unsere Auftrags-Nr. / Our Order No.:

Liefermenge / Quantity Delivered:

F.N.-Nr.: / F.N-No.:

### Analysenergebnisse / Analytical Results:

#### Siebanalyse / Teilchengröße:

> 45 µm **max. 25 %**

< 45 µm **min. 75 %**

#### Chemische Analyse / chemical Analysis:

Cu: **balance**

Sn: **9,5 - 10,5 %**

Ag: **9,5 - 10,5 %**

Fülldichte / Apparent Density:

**> 3,5 g/cm<sup>3</sup>**

Klopfdichte / Tap density:

Heißgepresste Probe (bei °C / 350 kg/cm<sup>2</sup> / 3 Minuten)

Hot-pressed Sample

Härte:

Dichte:

Bemerkungen / Remarks:

Dr. Fritsch GmbH & Co. KG

## RASTAR 80/10/10

Item Code: RASTAR 80/10/10

Issue Date: 20.08.2011

Product Specification: Copper-tin powder alloy silver containing, irregular shape

Chemical Composition:	Element	Unit	Min	Max
	Copper	%	79,0	81,0
	Tin	%	9,0	11,0
	Silver	%	9,0	11,0
	Silicon	%		0,2
	Phosphorus	%		0,1

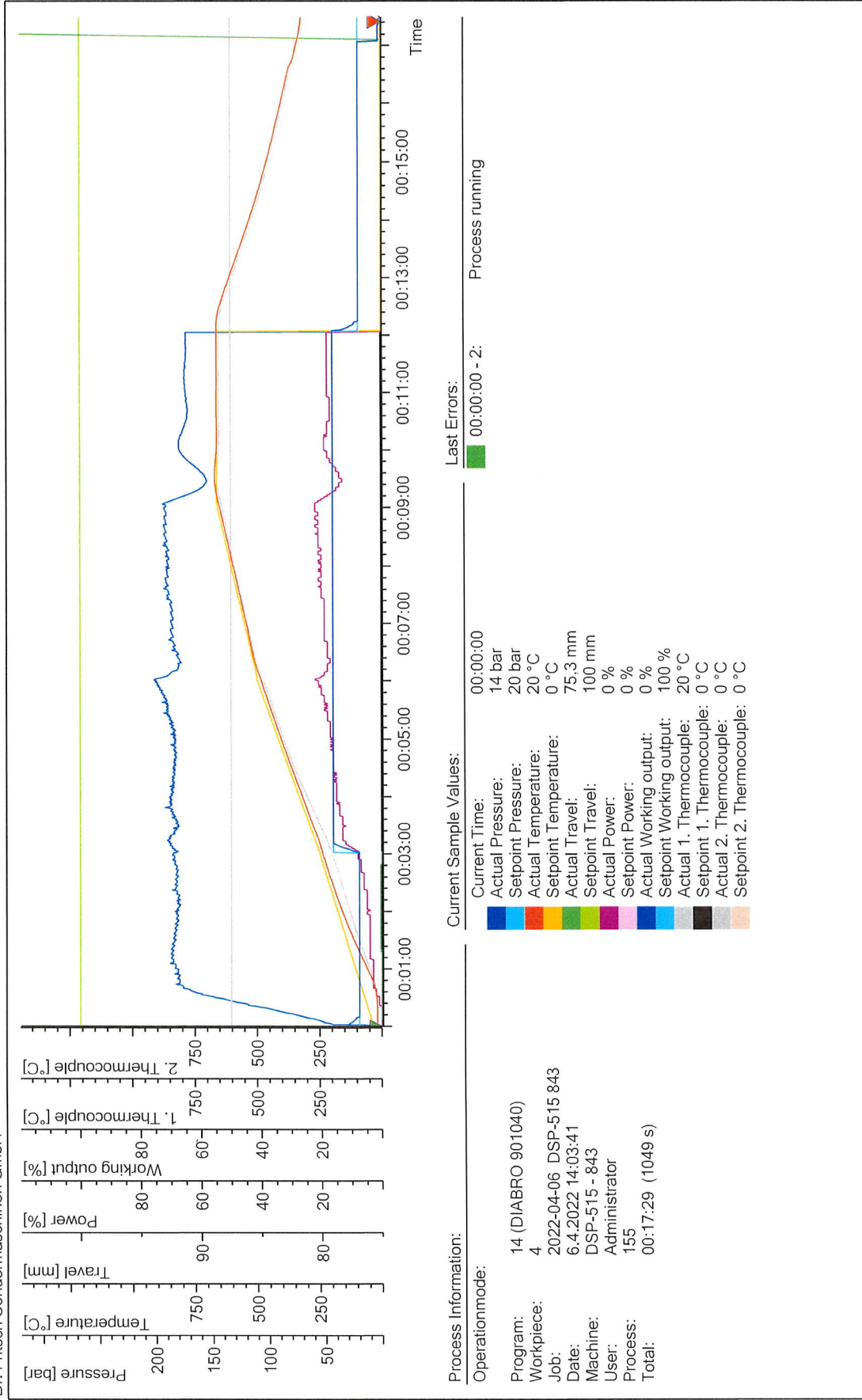
Particle Size:	Aperture in $\mu\text{m}$	Min	Max
	-150 +100		0,5
	-100 +75	3	7
	-75 +45	40	50
	-45	40	50

Physical Properties:	Characteristic	Unit	Min	Max	Method
	Apparent density	$\text{g/cm}^3$	4,0	4,5	ISO 3923-2
	Flow	s/50g			ISO 3923-1
	Melting range	$^{\circ}\text{C}$	750	810	
	Working temperature	$^{\circ}\text{C}$	760	760	



# PŘÍLOHA VI.

Dr. Fritsch Sondermaschinen GmbH



## Process Information:

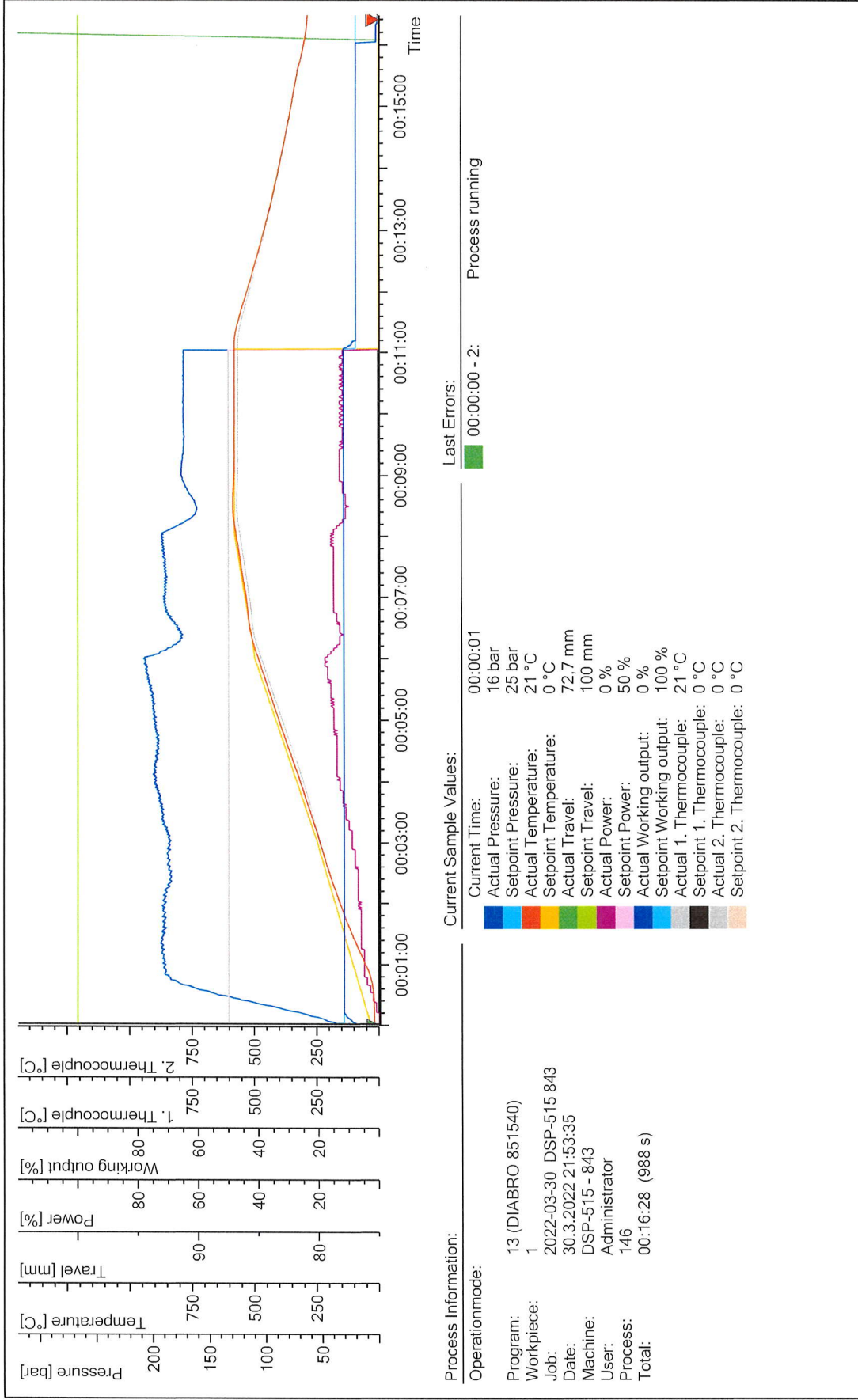
Operationmode:  
 Program: 14 (DIABRO 901040)  
 Workpiece: 4  
 Job: 2022-04-06 DSP-515 843  
 Date: 6.4.2022 14:03:41  
 Machine: DSP-515 - 843  
 User: Administrator  
 Process: 155  
 Total: 00:17:29 (1049 s)





# PŘÍLOHA VII.

Dr. Fritsch Sondermaschinen GmbH



### Process Information:

Operationmode:

Program: 13 (DIABRO 851540)  
 Workpiece: 1  
 Job: 2022-03-30 DSP-515 843  
 Date: 30.3.2022 21:53:35  
 Machine: DSP-515 - 843  
 User: Administrator  
 Process: 146  
 Total: 00:16:28 (988 s)

### Current Sample Values:

Current Time: 00:00:01  
 Actual Pressure: 16 bar  
 Setpoint Pressure: 25 bar  
 Actual Temperature: 21 °C  
 Setpoint Temperature: 0 °C  
 Actual Travel: 72.7 mm  
 Setpoint Travel: 100 mm  
 Actual Power: 0 %  
 Setpoint Power: 50 %  
 Actual Working output: 0 %  
 Setpoint Working output: 100 %  
 Actual 1. Thermocouple: 21 °C  
 Setpoint 1. Thermocouple: 0 °C  
 Actual 2. Thermocouple: 0 °C  
 Setpoint 2. Thermocouple: 0 °C

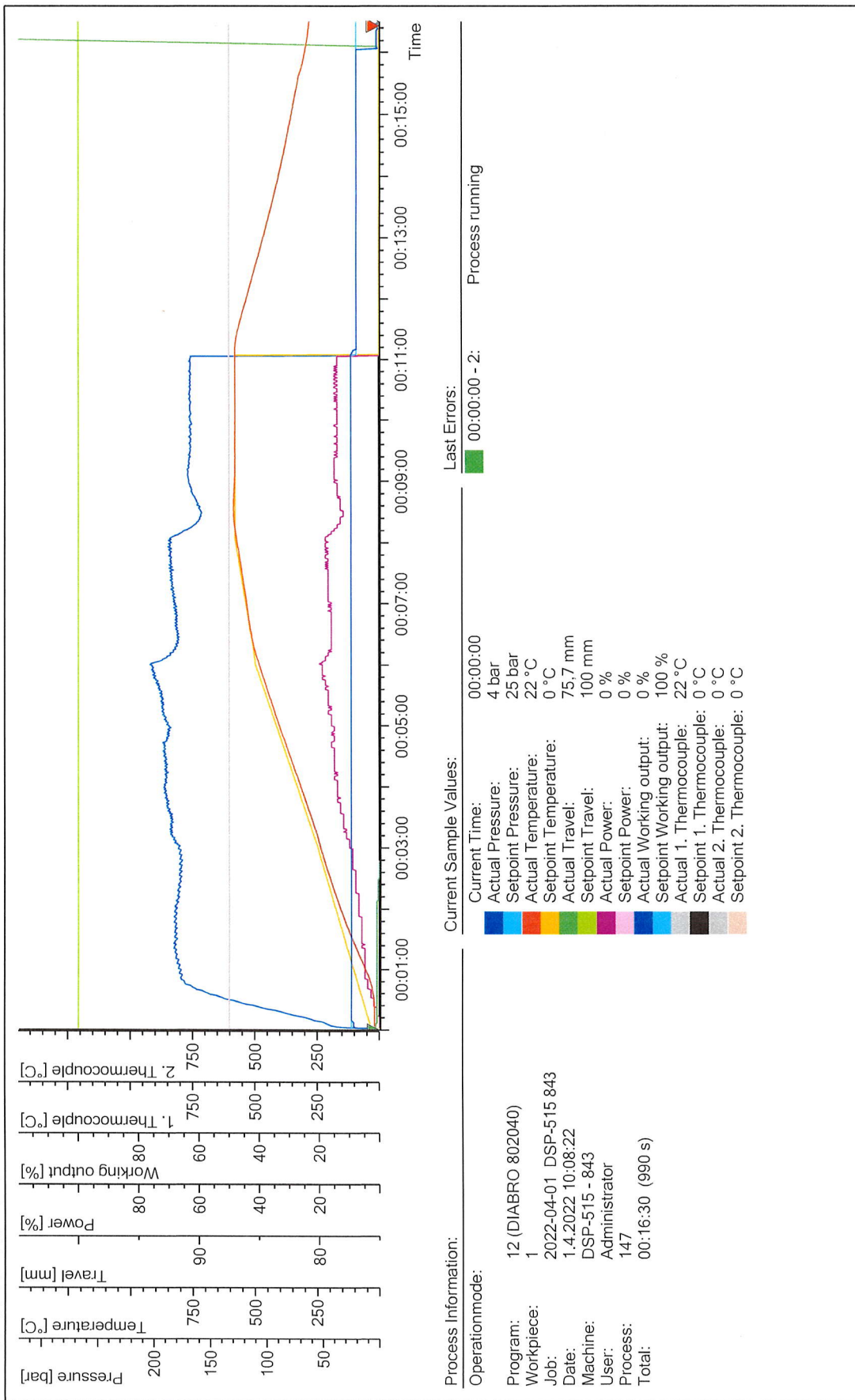
### Last Errors:

00:00:00 - 2: Process running



# PŘÍLOHA VIII.

Dr. Fritsch Sondermaschinen GmbH





# PŘÍLOHA IX.

Dr. Fritsch Sondermaschinen GmbH

