DALEX INDUSTRIAL WELDING MACHINES

CLASS PMS

DALEX Schweißmaschinen GmbH & Co. KG
The industrial manufacturing requires highest when it concerns capability, quality and reliability of welding machines in use.

The **DALEX PMS LINE** enables a range of machines to the industry which consistently proves its capability in a wide range of industrial applications.

### PERFORMANCE DATA

- **RATED POWER**
  - from 16 up to 630 kVA (alternating current),
  - from 60 up to 1200 kVA (three-phase direct current),
  - from 80 up to 1000 kVA (medium frequency);
- **ELECTRODE FORCE** 0,2-150 kN (20 up to 15000 daN)
- **MAXIMUM WELDING CURRENT** up to 300 kA

### CHARACTERISTICS

- modular design, modular construction system
- modification possibilities for individual applications
- wide range of accessories
- modern, efficient and robust
- Optimum quality and durability
- Exclusive high-grade components of well-known brands manufactures
- High performance transformers self manufactured without thermal problems for shift operation
EXECUTION PMS-MACHINES

**A**
SPOT-welding machine
with spot welding fitting and foot switch for spot welding

**B**
combined SPOT-PROJECTION-welding machine
with changeable fittings and key-operated switch for preselection of operation mode. Operation optional by foot switch or 2-hands safety start desk for spot- and projection welding

**C**
PROJECTION welding machine
with projection fitting and 2-hands safety start desk for projection welding

**NL**
LONGITUDINAL SEAM welding machine
with longitudinal welding heads and foot switch

**NQ**
TRANSVERSAL welding machine
with transversal welding heads and foot switch

**NQ1**
**NQ2**
**NQ3**
TRANSVERSAL welding machine
with top drive gear
TRANSVERSAL welding machine
with bottom drive gear
TRANSVERSAL welding machine
with top and bottom drive gear

WELDING METHODS / TYPE OF CONNECTION

**SPOT WELDING**
When spot welding, the parts pressed up against each other after the jointing component has been sufficiently heated are connected by means of spot welding electrodes via current flow. The joint is made by melting and hardening the material at the joint.

**PROJECTION WELDING**
When projection welding, the heating and current flow required for welding is generated by the projection form. In resistance projection welding the electrodes only serve to provide current and power

**SEAM WELDING**
In seam welding, the roll formed electrodes press the sheets together and transfer the welding current. The welding spots are set so densely by the rolls that a coherent thick seam is formed.
DALEX INDUSTRIAL WELDING MACHINES

MODELS OF CYLINDERS

All electrode force cylinders are designed & built in accordance with the tandem principle using double air chambers and 2 working pistons. A relatively large electrode force is achieved despite smaller dimensioning through the arrangement of coupled working pistons.

Cylinders are fitted with precision guides, guaranteeing an optimum repositioning behaviour with the sealing elements available.

Safe anti-rotational protection is achieved through additionally positioned guide pins behind the piston rod.

SERVO MOTOR DRIVEN EXECUTIONS

DALEX SERVOTRONIC® PRODUCT RANGE

Our developers have provided the DALEX „S-class“ with a new design featuring 3 power stages.

SERVO MOTOR DRIVEN EXECUTIONS

SII 1000
10 kN (1000 daN)

SII 2000
20 kN (2000 daN)

SII 4000
40 kN (4000 daN)
WELDING METHODS / TYPE OF CURRENT

**ALTERNATING CURRENT**
Alternating current welding (AC welding) means the mains supply voltage of 400 V 2-phase (e.g. L1-L2) is switched to a welding transformer per thyristor, where it is transformed over to ca. 5-9 V secondary voltage. Mains voltage / $\bar{U}$ = secondary voltage. Behaviour of the currents is exactly opposite, i.e. secondary current / $\bar{I}$ = primary current.

**3-PHASE DIRECT CURRENT**
For welding with a 3-phase direct current machine, use is made of three precision-adapted transformers, whereby individual groups of rectifiers are installed on the secondary side of the transformers, which generate parallel switched direct current (6 pulse mid-point tapping). Current and voltage behaviour is in principle, similar to that of an alternating current machine.

**MEDIUM FREQUENCY**
With medium frequency welding (MF welding), the current is chopped from mains frequency up to 1000 Hz by means of an inverter and sent to the welding transformer. On the secondary side, the current is then rectified through water-cooled diodes, so that likewise direct current is formed.

**CAPACITOR DISCHARGE**
In the case of capacitor discharge welding, the energy required for welding is discharged from a previously charged capacitor bank through a thyristor on a welding transformer. Due to the somewhat relatively high idling voltage of the transformer of up to 45V and the sudden discharge of the energy stored in the condenser, the current in the secondary circuit rises very quickly (direct current pulse).

COMPARISON OF CURRENT TYPES

The following example is based on 350 mm throat length:

<table>
<thead>
<tr>
<th>execution</th>
<th>welding current</th>
<th>mains cross section</th>
<th>fuse protection</th>
</tr>
</thead>
<tbody>
<tr>
<td>alternating current / AC</td>
<td>57 kA</td>
<td>150 mm$^2$</td>
<td>315 A</td>
</tr>
<tr>
<td>3-phase direct current / DC</td>
<td>57 kA</td>
<td>25 mm$^2$</td>
<td>100 A</td>
</tr>
<tr>
<td>medium frequency / MF</td>
<td>57 kA</td>
<td>25 mm$^2$</td>
<td>100 A</td>
</tr>
<tr>
<td>capacitor discharge / KE</td>
<td>57 kA</td>
<td>25 mm$^2$</td>
<td>32 A</td>
</tr>
</tbody>
</table>
### TECHNICAL DATA

#### type PMS 10-6 T

- **nominal power (50 % DC)**: 16 / 32 kVA
- **throat length**: 200 / 350 / 550 mm
- **electrode force**:
  - (1 kN = 100 daN)
  - 0,65 - 3,9 / 0,2 - 3,9 kN
- **stroke**: max. 65 mm
- **possible executions**: A / B or C

#### type PMS 10-6

- **nominal power (50 % DC)**: 80 kVA
- **throat length**: 250 / 350 / 550 / 750 / 1050 mm
- **electrode force**:
  - (1 kN = 100 daN)
  - 0,65 - 3,9 / 0,2 - 3,9 / 1,15 - 6,9 kN
- **stroke**: max. 65 mm
- **possible executions**: A / B or C

#### type PMS 14-6

- **nominal power (50 % DC)**: 100 / 160 / 200 kVA
- **throat length**: 250 / 350 / 550 / 750 / 1050 mm
- **electrode force**:
  - (1 kN = 100 daN)
  - 2 - 12 / 0,8 - 12 / 3 - 18 kN
- **stroke**: max. 100 mm
- **possible executions**: A / B / C or N

#### type PMS 16-6

- **nominal power (50 % DC)**: 200 / 250 kVA
- **throat length**: 350 / 550 / 750 / 1050 mm
- **electrode force**:
  - (1 kN = 100 daN)
  - 3,4 - 20,4 / 1,4 - 20,4 / 5 - 30 kN
- **stroke**: max. 120 mm
- **possible executions**: A / B / C or N

* * description of executions can be found on page 3
### TECHNICAL DATA

<table>
<thead>
<tr>
<th>Type</th>
<th>PMS 11-6</th>
<th>PMS 12-6</th>
<th>PMS 32-6</th>
<th>PMS 36-6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Power (50% DC)</td>
<td>80 / 100 kVA</td>
<td>100 / 160 / 200 kVA</td>
<td>100 / 160 / 200 kVA</td>
<td>160 / 200 / 250 kVA</td>
</tr>
<tr>
<td>Throat Length</td>
<td>250 / 350 / 550 / 750 / 1050 mm</td>
<td>350 / 550 / 750 / 1050 mm</td>
<td>250 / 350 mm</td>
<td>175 / 250 mm</td>
</tr>
<tr>
<td>Electrode Force (1 kN = 100 daN)</td>
<td>1 - 6 / 0,2 - 6 / 1,9 - 11,4 kN</td>
<td>1,2 - 7,2 / 1,65 - 9,9 / 2,15 - 12,9 / 3 - 18 / 1,35 - 18 kN</td>
<td>1,2 - 7,2 / 1,65 - 9,9 / 2,15 - 12,9 / 3 - 18 / 1,35 - 18 kN</td>
<td>3,6 - 21,6 / 1,6 - 21,6 / 5 - 30 / 2,3 - 30 / 1,35 - 18 kN</td>
</tr>
<tr>
<td>Stroke</td>
<td>max. 90 mm</td>
<td>max. 100 mm</td>
<td>max. 100 mm</td>
<td>max. 120 mm</td>
</tr>
<tr>
<td>Possible Executions*</td>
<td>A / B / C / N</td>
<td>A</td>
<td>C</td>
<td>C</td>
</tr>
</tbody>
</table>

* Description of executions can be found on page 3.
OPTIONAL FEATURES

4-RANGE SELECTOR SWITCH for coarse adjustment of the welding performance

MAIN SWITCH according to VDE installed in attached cabinet.

EMERGENCY-OFF-BUTTON mounted on the cylinder

FLOW CONTROL INSTRUMENT (water control switch) installed in water feed

ADJUSTMENT DEVICE with ratchet for height adjustment of bottom fitting

LOWER ARM SUPPORT

CLAMPING PIECE for lower arm support

CLAMPING PIECE with ratchet

TUBE ARM for bottom spot fitting

TUBE ARM FITTING with special wide working length of the spot fitting

AIR PRESSURE REGULATOR

WATER FLOW CONTROL 4-fourfold

SAFETY VALVE 2-channel version

WATER SEPARATOR for pressure air

DOUBLE FILTER AND DIFFERENTIAL PRESSURE CONTACT DISPLAY for cooling water

PRESS PLATE for mounting of the lower clamping plate

CLAMMING PLATE at the top

CLAMMING PLATE at the bottom

LAMINTATED POWER-STRIP

POWER BRIDGE

Further accessories are contained in our DALEX Components Catalogue
<table>
<thead>
<tr>
<th>Optional Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Projected Electrode Holder</td>
</tr>
<tr>
<td>Vise Electrode</td>
</tr>
<tr>
<td>Bar Electrode</td>
</tr>
<tr>
<td>Pressure Compensator for projection welding tools</td>
</tr>
<tr>
<td>Flange Electrode Holder for use of a projection welding machine as spot welding machine</td>
</tr>
<tr>
<td>Hydraulic Welding Unit (compensating element)</td>
</tr>
<tr>
<td>Spring Electrode Holder (for quick electrode follow up characteristic)</td>
</tr>
<tr>
<td>Bar Electrode Holder</td>
</tr>
<tr>
<td>Pendulum Electrode Holder</td>
</tr>
<tr>
<td>Seam Roll Electrodes</td>
</tr>
<tr>
<td>Pressureless Lowering of upper welding attachment via manual valve at the cylinder</td>
</tr>
<tr>
<td>Electrode Force-Switch electronically</td>
</tr>
<tr>
<td>Return Stroke Monitoring Electronically</td>
</tr>
<tr>
<td>Program Selector Switch for preselection of the welding program</td>
</tr>
<tr>
<td>Position Encoder Electronically</td>
</tr>
<tr>
<td>Foot Pedal Switch - single foot pedal switch</td>
</tr>
<tr>
<td>Two Hand Safety Start Console</td>
</tr>
<tr>
<td>Rapid Retooling System for quick changing of the welding tools</td>
</tr>
<tr>
<td>Quick Coupling Water connection for welding tools</td>
</tr>
<tr>
<td>Proportional Valve incl. safety sinking device and electrode force monitoring</td>
</tr>
</tbody>
</table>

Further accessories are contained in our DALEX Components Catalogue
3-PHASE DIRECT CURRENT TECHNOLOGY

RANGE OF 3-PHASE DIRECT CURRENT

The DALEX DC current range embodies a machine concept whereby, in addition to special economic productivity and dependable continuous operation, each machine is easy to maintain and reliability of all components is a true reality. Every diode can be tested individually and exchanged if by chance the need arises. Further advantages include close-coupling and minimised losses.

Transformers are cast in a vacuum and fitted with a temperature sensor to avoid the dangers of overloading. Diodes are thermally monitored to ensure reliable duty cycles. If a certain threshold temperature is exceeded, then the machine will be switched off automatically.

All machine frames are designed & built with distortion-resistant, generously dimensioned sectional frame welded construction, and yet still enabling free access to all components.

PERFORMANCE DATA

■ NOMINAL POWER
  Rectifier sets from 60 up to 1200 kVA

■ ELECTRODE FORCE
  from 0,2 up to 150 kN (20 - 1500 daN)

■ MAXIMUM WELDING CURRENT
  up to 300 kA

ADVANTAGES

■ low trend-to-alloy of the electrodes
■ short welding duration with reduced heat affected zone
■ good conditions for mains connection
■ uniform current partition in electrodes and work piece
■ big power factor - small losses
■ low energy consumption
■ high welding current with lower secondary voltage
**MEDIUM FREQUENCY TRANSFORMATOR**

### TECHNICAL DATA

<table>
<thead>
<tr>
<th>Transformers</th>
<th>Nominal Power @ 20% DC</th>
<th>No-Load Direct Voltage</th>
<th>Weight</th>
<th>Number of Diodes</th>
</tr>
</thead>
<tbody>
<tr>
<td>MF 80 - 90 kVA</td>
<td>80 - 90 kVA</td>
<td>6.3 - 8.3 V</td>
<td>17 kg</td>
<td>2 pieces</td>
</tr>
<tr>
<td>MF 130 - 180 kVA</td>
<td>130 - 180 kVA</td>
<td>7.0 - 10.2 V</td>
<td>26.4 kg</td>
<td>4 / 6 pieces</td>
</tr>
<tr>
<td>MF 250-300 kVA</td>
<td>250-300 kVA</td>
<td>10.2 - 16.0 V</td>
<td>33 kg</td>
<td>4 / 6 pieces</td>
</tr>
<tr>
<td>MF 500 kVA</td>
<td>500 kVA</td>
<td>11.8 V</td>
<td>54.5 kg</td>
<td>6 pieces</td>
</tr>
<tr>
<td>MF 700 - 1000 kVA</td>
<td>700 - 1000 kVA</td>
<td>8.4 - 15.9 V</td>
<td>167 kg</td>
<td>10 pieces</td>
</tr>
</tbody>
</table>

### CHARACTERISTICS
- low self-impedance
- series connection of all cooling circuits
- sec. voltage suppressor wiring beginning with MF 180
- diodes are tightened max. as a pair
- high capability with small size

### ADVANTAGES
- direct current in high quality
- minimal inductive loss
- energy saving
- regulation and time adjusting in ms
- fast upslope
- long life of electrodes
- compact and lightweight transformer
- high quality of welding spot
- wide range welding application
- symmetrical load of supply network
- low trend of spatter formation

### METHOD

In an special inverter the three-phase power supply is rectified and converted to alternating two phase current of 1000 Hz. A compact, close coupled transformer is primary fed with this current, which is rectified again on secondary side. The result is a welding current which can be regulated fast and precise because of the 1000 Hz.

### PLANNED USE
- short-time welding (f. e. annular projections), partially as replacement of capacitor discharge welding machines
- welding of galvanized sheets
- joining of different materials as well as nonferrous metals
- welding of coated materials

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**LIFE OF ELECTRODES - MF DIRECT CURRENT / ALTERNATING CURRENT**

**COMPARISON OF WELDING CURRENT CURVES**
CD-TECHNOLOGY

THE POWER OF DISCHARGE

PLANNED USE

- High welding currents
  - large ring projections
  - multiple projection welds
  - high-alloyed steels
- Heat-sensitive components
- Sealing areas
- Electronic components
- Distortion-free components
- Hard-to-weld parts
  - hardened components
  - mixed compounds
  - sinter metals
  - steel & grey-cast castings

CARACTERISTICS

- rapid up-slope
- short welding time
- high welding current
- rapid heat conduction in the seam zone allows welds without appreciable heating of surrounding material

ADVANTAGES

- low demands on your mains supply
- savings on energy needs
- no water cooling needed
- more efficient tool life

TECHNICAL DATA

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>max. welding power</td>
<td>18.000 – 36.000 Ws</td>
</tr>
<tr>
<td>electrode force</td>
<td>7 - 42 kN (700 - 4200 daN)</td>
</tr>
<tr>
<td>No. weld sequences @ 10 mm stroke</td>
<td>60 / min</td>
</tr>
<tr>
<td>pre-stroke</td>
<td>150 mm</td>
</tr>
<tr>
<td>working stroke</td>
<td>0 - 150 mm</td>
</tr>
<tr>
<td>standard throat depth</td>
<td>350 mm</td>
</tr>
<tr>
<td>load time</td>
<td>0,5 - 2,5 s</td>
</tr>
<tr>
<td>welding time</td>
<td>3 - 10 ms</td>
</tr>
<tr>
<td>efficiency</td>
<td>&gt; 90 %</td>
</tr>
</tbody>
</table>

Energy and electrode force are variable. Welding time is a machine constant.
DALEX-SERVOTRONIC®

CHARACTERISTICS

- Dynamically readjusts the welding parameters by virtue of an intelligent control technology
- Ensures optimal lens formation in resistance welding to a high degree.
- Welds an enormous variety of material pairings
- Avoidance of spatters inside the thread when nut welding is solvable

METHOD

What this means for spot, projection or seam welding is illustrated by the second generation of DALEX servomotor welding machines.

Instead of simply „flattening“ the projections before the actual welding process, as would be the case with conventional pneumatic systems, the geometry of the projections is kept completely intact with a DALEX SERVOTRONIC®.

ADVANTAGES

Process safety and welding quality are drastically increased.

The success factors:

- Die-to-die blow-free welding electrode touch-down on the component
- Constantly adjusted preliminary force for defined press-on of components to be welded (projection geometry remains intact)
- Welding current build-up synchronized with welding force build-up with an also constantly adjusted end force
- Optimal process operation reproducibility with typical welding cycles of 20 to 150 ms

SCHEMATIC: DYNAMIC CHARACTERISTICS OF A SERVO-MOTOR DALEX-PROJECTION WELDING MACHINE WITH SERVOTRONIC®
The DALEX concept of modifications of high-capable standard machines in response to individual demands is a well proved and secured base for industrial welding with high productivity and economic efficiency.

The machines are used in the various branches such as automotive manufacturing, utility and agricultural manufacturing, aircraft construction, wire grating manufacturing, luminous advertising, household appliances, electrical engineering, furniture manufacturers as well as window and door manufacturers.

For complex welding applications the series of DALEX machines type PMS can be fast and cost efficient modified thanks to their modular design. For reproducible welding results they can be completed by special tools designed for the intended application.
MODIFIED PMS CLASS EXAMPLES OF USE

HOUSEHOLD TECHNOLOGY

MACHINE DESCRIPTION
DALEX-transversal seam welding machine type PMS 11-6 with special fittings

WELDING TASK
tab-spot welding of sinking basin

MACHINE DESCRIPTION
DALEX-spot welding machine type PMS 16-6

WELDING TASK
seam welding of lye drums

MACHINE DESCRIPTION
DALEX-transversal seam welding machine type PMS 14-6 with special fittings

WELDING TASK
seam welding of chimney pipe

MACHINE DESCRIPTION
DALEX-projection welding machine type PMS 36-6 with special tools and feeding device

MACHINE DESCRIPTION
DALEX-projection welding machine type PMS 36-6 with special tools and feeding device

MACHINE DESCRIPTION
projection welding of fire-extinguisher case
MODIFIED PMS CLASS EXAMPLES OF USE

AUTOMOTIVE INDUSTRY

MACHINE DESCRIPTION
DALEX-double head projection welding machine type **PMS 32-6** with special tools

WELDING TASK
projection welding of hinge reinforcement

AUTOMOTIVE INDUSTRY

MACHINE DESCRIPTION
DALEX-medium frequency projection welding machine type **PMS 32-6 MF** with special welding tool

WELDING TASK
projection welding of fuel distributor

AUTOMOTIVE INDUSTRY

MACHINE DESCRIPTION
DALEX-medium frequency projection welding machine type **PMS 36-6 MF** with special fittings

WELDING TASK
projection welding of adapter on flue gas part

AUTOMOTIVE INDUSTRY

MACHINE DESCRIPTION
DALEX-foil seam welding machine type **PMS 14-6** with special foil seam welding device

WELDING TASK
foil seam welding of heat exchanger for passenger cars and commercial vehicles
MODIFIED PMS CLASS EXAMPLES OF USE

**AUTOMOTIVE INDUSTRY**

**MACHINE DESCRIPTION**
DALEX-medium frequency 3-cylinder projection welding machine type **PMS 37-6 MF** with special tools

**WELDING TASK**
projection welding of parts for automotive manufacturing

**AUTOMOTIVE INDUSTRY**

**MACHINE DESCRIPTION**
DALEX-projection welding machine type **PMS 32-6** with automatic nut feeding device and special tools

**WELDING TASK**
projection welding of nuts on sheet metal parts

**WINDOWS & DOORS**

**MACHINE DESCRIPTION**
DALEX-double head projection welding machine type **PMS 36-6** with special fittings

**WELDING TASK**
projection welding of case of a lock on lock plate

**WINDOWS & DOORS**

**MACHINE DESCRIPTION**
DALEX-projection welding machine type **PMS 36-6** with special welding tool

**WELDING TASK**
projection welding of lock case on door frame
MACHINE DESCRIPTION
DALEX-medium frequency projection welding machine type PMS 36-6 MF with special welding tool

WELDING TASK
projection welding of cylindrical tubes

MACHINE DESCRIPTION
DALEX-bench type spot welding machine type PMS 10-6 T with special fittings

WELDING TASK
spot welding of copper stranded wire on mains terminal

MACHINE DESCRIPTION
DALEX-3-phase direct current projection welding machine type PMS 37-6 G3 with wide-spread clamping plate

WELDING TASK
welding of clip-on electric contacts

MACHINE DESCRIPTION
DALEX-3-phase direct current projection welding machine type PMS 38-6 G3 with special welding tool

WELDING TASK
projection welding of diffuser on compressor housing
**MACHINE DESCRIPTION**

DALEX-medium frequency projection welding machine type **PMS 14-6 MF** with special welding tool

**WELDING TASK**

projection welding of wire console

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**MACHINE DESCRIPTION**

DALEX-transversal seam welding machine type **PMS 11-6** with special fittings

**WELDING TASK**

seam welding of filter sieve

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**MACHINE DESCRIPTION**

DALEX-3-phases direct current welding machine type **PMS 11-6 G3** with special fittings

**WELDING TASK**

spot welding of luminous aluminium letters

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**MACHINE DESCRIPTION**

DALEX-seam welding machine type **PMS 10-6 T** with special welding tool

**WELDING TASK**

seam welding of filtering bag fabrics