

**Bore Expanding ISO 16630**



**Deep Drawing Cup Test**

# **Universal Sheet Metal Testing Machine Model 142**



**Square Deep Drawing Cup Test**



**Option: HEXRASCAN  
and insertion device**



testing equipment for quality management

**ERICHSEN**  
since 1910

**Technical Description**

**FLC-Test  
Bulge-Test**

**Software for  
Data Evaluation and  
Processing**

**With  
electro-hydraulic Drive  
Programme Logic Control**

## Product

Universal Sheet Metal Testing Machine with electro-hydraulic drive, fully automatic test sequence and switch off at specimen failure, max. drawing forces 200 kN or 400 kN - **Model 142-20** and **Model 142-40**.

## Application

This Testing Machine can be used not only to perform effortlessly, quickly and accurately all important and known deep drawing tests for ferrous and non-ferrous metals, but it is also designed for a large number of additional technological investigations:

### **ERICHSEN Cupping Test** in accordance with

DIN EN ISO 20482	JIS Z-2247
NF A 03-602	
NF A 03-652	
ASTM 643	GOST 10 510
GB 4156-07	

### **ERICHSEN Deep Drawing Cup Test**

in accordance with

DIN EN 1669
ISO 11 531
JIS Z 2249
GB/T 15825

on sheet and strip

**Square Cup Test** (40 x 40 mm)

**Bore Expanding Test (KWI Test)**

**Determination of the Forming Limit Curves (FLC) – only for Model 142-40**

**Deep Drawing Test with Blankholder Quick Release** (for Earing Test)

**Deep Drawing Test with Preselected Punch Stroke**

**Deep Drawing Test at High Temperatures up to 550 °C**

**Bulge Test** acc. to ISO 16808

**ERICHSEN Cupping Test for Lacquer and Paint**  
in accordance with DIN ISO 1520

**Stamping Lacquer Test and Deep Drawing Cup Test on Coil Coatings**

**Special Requirements on request.**

## Description

All components are easily accessible from outside the machine, and thus the tools for the individual tests can be changed quickly, too. The clear arranged menu navigation via the touch panel (99 freely programmable programs and tool changes) has password-protected levels, which protect against unauthorized access.



The Testing Machine is driven electro-hydraulically. The test sequence can be controlled automatically or manually, as desired. A programme logic control is used to control the functions of the machine. Drawing force and blankholder force as well as the drawing punch stroke are displayed digitally. The triple-acting hydraulic system in conjunction with the general design results in the following cost saving simplifications:

- ◆ Blanking press in the test head
- ◆ Hydraulic cup ejector
- ◆ Fully-automatic test sequence.

### **Further technical advantages:**

- ◆ *Cylinder head with bayonet lock* permitting direct access to drawing dies, blanking rings, blank holders etc. and quick and convenient changing of the drawing and blanking tools.
- ◆ *Infinitely variable drawing speed* once set it remains constant throughout the drawing movement, independent of any change of load
- ◆ *Cardanic drawing die retention* ensures the consistent, parallel clamping of the specimen, independent of variations in thickness.

The Sheet Metal Testing Machine, Model 142, was developed not only for testing as a means for continuous production control, using standardised and other established methods, but also for research into all aspects of testing of sheet metal for deep drawing by studying all that is relevant to sheet metal forming.

## **Additional Control Functions and Test Methods**

Upon request, Model 142, can be equipped with analogue outputs for connection of a PC

### **Special insertion device for specimen sheets**

allows easy and quick insertion and retraction of the specimen without having to unlock and open the head of the test cylinder.

### PC and Software Package

A special software programme has been developed for the modified ERICHSEN cupping test. The signals for the drawing punch stroke, the drawing force and the blankholder force can also be transmitted to a PC. A force/displacement diagram appears on the VDU.

For conducting the Deep Drawing Cup Test, for example in accordance with DIN 50 155, a special software pack is available producing a force/displacement diagram over the full forming range as well as numerical results for drawing punch stroke, drawing force and blankholder force.

### Hot Drawing Equipment up to 550 °C

A further valuable addition to the possibilities offered by Model 142 is provided by the additional hot drawing equipment (Fig. 1). In this, the blankholder and drawing die are heated in an insulated container and special provision is made to enable these then to be set up without difficulty on the machine. An electronic temperature measuring device is incorporated, and on this the preset intended temperature and the current measure temperature are displayed. The preset temperature can be set up to 550 °C, and in the test, the temperature remains constant within ± 10 °C.



Fig. 1

### Hot Drawing Equipment up to 700 °C (only for Mod.142-40)

To determine also Forming Limited Diagrams at higher temperatures, the temperature accessory for Mod. 142-40 is the appropriate solution.

Tests according Nakajima- and Marciniak can be performed in order to evaluate FLC / FLD. This accessory will be assembled directly into the test cylinder. Hereby, the complete tool is heated to the desired temperature together with the test specimen, and then the deformation will be performed.

By using a cooling connection the jacket of the device can be cooled, thus the thermal load on the environment is minimized. The corresponding electronic control units are placed in a separate cabinet. The opening in the test head of the hot-drawing device is manufactured, that optical 3D measurement systems can document and evaluate the deforming process.



Fig. 2  
Hot Drawing Equipment

### HEXRASCAN I / II (Typ II only for Mod. 142-40)

Camera with traversing bar and lighting, for rupture detection according to ISO 16630 'hole expansion test' (HEXRASCAN I) or for strain measurement on flat sheet metal specimen (e.g. PV 1054) (HEXRASCAN II). An appropriate recording and analysis software is included.



Fig. 3 – HEXRASCAN I,

### Technical Data

Drawing force	142-20	200 kN
	142-40	400 kN
Blanking force	142-20	260 kN
	142-40	600 kN
Blankholder force	142-20	up to 100 kN
	142-40	2 - 100 kN and 10 - 400 kN
Drawing punch stroke	142-20	approx. 80 mm
	142-40	approx. 120 mm
Blankholder stroke		approx. 38 mm
Drawing punch dia.	142-20	up to 50 mm
	142-40	up to 75 mm
FLC test (drawing punch- $\emptyset$ )		up to 100 mm
Bulge test (bulge- $\emptyset$ )		up to 100 mm
Blank diameter	142-20	up to 120 mm
	142-40	approx. 170 mm
Drawing speed	142-20	approx. 800 mm/min
	142-40	approx. 900 mm/min
Digital displays		Resolution:
Drawing punch stroke		0.1 mm (on request 0.01 mm)
Drawing force		0.1 kN
Blankholder force		0.1 kN
Mains supply		400 V / 3~, 50/60 Hz (other voltages on request)
Power required		9.4 kW
Dimensions (L x W x H)		
142-20		approx. 2000 x 1120 x 1300 mm
142-40		approx. 2000 x 1120 x 1300 mm
Weight, net	142-20	approx. 1300 kg
	142-40	approx. 1700 kg

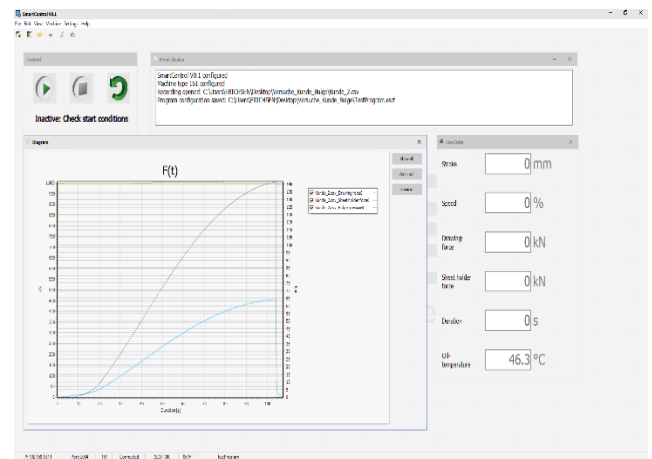
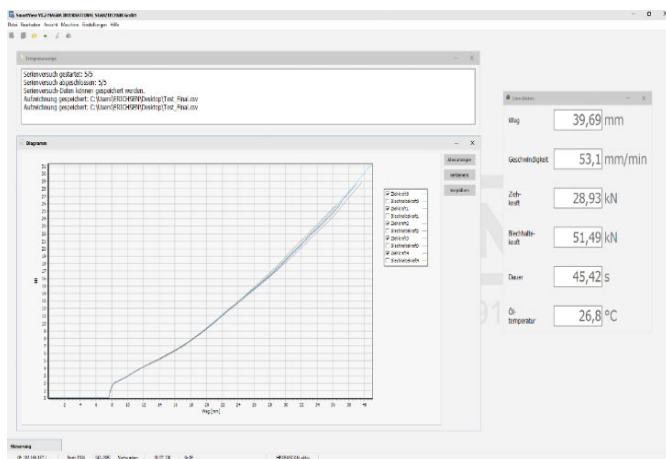
## For the modified ERICHSEN Cupping Test the user can search between two versions of user test software:

The ERICHSEN Cupping Test (in accordance with EN ISO 20482, and corresponding to national and international standards) is a test providing simple and quick means of assessing the multi-axis ductility of sheet and strip using a procedure that relates closely to practical processes. The depth range reached at failure is, however, only an initial guide to the evaluation of the forming properties of the sheet metal.

The Universal Sheet Testing Machine, Model 142, (as is the case with all the modern electro-hydraulic ERICHSEN Testing Machines) can as an option be equipped with analogue measuring outputs for

- ◆ drawing punch movement,
- ◆ drawing force, and
- ◆ blankholder force.

These analogue measuring signals can be transmitted to a PC via an amplifier and an A/D converter.



## Data Evaluation System with User Test Software SmartView

The software enables the continuous acquisition of measured values with simultaneous display of the force/displacement diagram throughout the forming process. The connection is made by an Ethernet connection. The data recording will be stopped after the maximum force is achieved in a cupping test or the deep draw test is finished.

This data is presented immediately on the VDU on completion of the test alongside the graph of the force against displacement.

The software included in the scope of supply runs under WIN 10. Either a printout can then be obtained and the data saved or the data can be easily transferred to other evaluation programmes (e.g. Microsoft Excel).

The scope of supply includes PC and VDU.

## Universal User Software with PC SmartControl

The software enables the control, adjustment, documentation and filing of measuring data of the sheet metal testing machine. Software for recording of force-displacement diagrams such as drawing force and blank holder force, stroke. Creation of scripts (test sequences); presetting of freely selectable parameters such as drawing and blank holder force as well as drawing speed.

The measuring system integrated in the sheet metal testing machine is designed in modular system with analogue and digital inputs and outputs. Hereby drawing force, blank holder force and stroke are acquired. The connection is made by an Ethernet connection. The data will be exchanged with the PC via a USB connection. This programme enables to create and evaluate test sequences for tests e.g. Erichsen deep-drawing cup test, bore expanding test, bulge test, Erichsen deep drawing test (only in connection with the proportional valve technique).

The software included in the scope of supply runs under WIN 10.

The scope of supply includes PC and VDU.

<b>Selection table for drawing dies B1/C2            (#01370132)</b> valid for <b>ferrous and non-ferrous</b> material (material type necessary for order) Norm: ERICHSEN			
Var.	Thickness s / mm	Var.	Thickness s / mm
1	0,076	28	0,85
2	0,100	29	0,90
3	0,127	30	0,95
4	0,13	31	1,00
5	0,14	32	1,10
6	0,15	33	1,15
7	0,18	34	1,20
8	0,20	35	1,25
9	0,21	36	1,30
10	0,23	37	1,40
11	0,24	38	1,50
12	0,25	39	1,60
13	0,26	40	1,70
14	0,27	41	1,80
15	0,28	42	1,90
16	0,30	43	2,00
17	0,32	44	2,10
18	0,35	45	2,20
19	0,40	46	2,30
20	0,45	47	2,40
21	0,50	48	2,50
22	0,55	49	2,60
23	0,60	50	2,65
24	0,65	51	2,70
25	0,70	52	2,8
26	0,75	53	2,9
27	0,80	54	3,0

<b>Selection table for drawing dies B1/C2            (#01370132)</b> valid for <b>aluminium and aluminium alloy</b> Norm: DIN EN 1669			
valid for Clearance ratio <b>1,15 bis 1,52</b>		valid for Clearance ratio <b>1,34 bis 1,76</b>	
Var.	Thickness s / mm	Var.	Thickness s / mm
1	0,095 < s ≤ 0,120	1	0,080 < s ≤ 0,100
2	0,121 < s ≤ 0,150	2	0,101 < s ≤ 0,125
3	0,151 < s ≤ 0,185	3	0,126 < s ≤ 0,157
4	0,186 < s ≤ 0,235	4	0,158 < s ≤ 0,195
5	0,236 < s ≤ 0,280	5	0,196 < s ≤ 0,240
6	0,281 < s ≤ 0,345	6	0,241 < s ≤ 0,290
7	0,346 < s ≤ 0,435	7	0,291 < s ≤ 0,360
8	0,436 < s ≤ 0,535	8	0,361 < s ≤ 0,450
9	0,536 < s ≤ 0,665	9	0,451 < s ≤ 0,555
10	0,666 < s ≤ 0,800	10	0,556 < s ≤ 0,670
11	0,801 < s ≤ 0,940	11	0,671 < s ≤ 0,800
12	0,941 < s ≤ 1,130	12	0,801 < s ≤ 0,965
13	1,131 < s ≤ 1,450	13	0,966 < s ≤ 1,250
14	1,451 < s ≤ 1,900	14	1,251 < s ≤ 1,600
15	1,901 < s ≤ 2,350	15	1,601 < s ≤ 2,000
16	2,351 < s ≤ 2,900	16	2,001 < s ≤ 2,400
17	2,901 < s ≤ 3,500	17	2,401 < s ≤ 3,000

<b>Selection table for drawing dies B1/C2            (#01370132)</b> valid for <b>ferrous and non-ferrous</b> material (material type necessary for order) Norm: ISO 11531			
Var.	Thickness s / mm	Var.	Thickness s / mm
1	0,1 < s ≤ 0,2	4	0,8 < s ≤ 1,6
2	0,2 < s ≤ 0,4	5	1,6 < s ≤ 3,0
3	0,4 < s ≤ 0,8		

**Selection table for drawing dies C1  
(#01410132)**

valid for **ferrous and non-ferrous** material  
(material type necessary for order)

Norm: ERICHSEN

Var.	Thickness s / mm	Var.	Thickness s / mm
1	0,076	28	0,85
2	0,100	29	0,90
3	0,127	30	0,95
4	0,13	31	1,00
5	0,14	32	1,10
6	0,15	33	1,15
7	0,18	34	1,20
8	0,20	35	1,25
9	0,21	36	1,30
10	0,23	37	1,40
11	0,24	38	1,50
12	0,25	39	1,60
13	0,26	40	1,70
14	0,27	41	1,80
15	0,28	42	1,90
16	0,30	43	2,00
17	0,32	44	2,10
18	0,35	45	2,20
19	0,40	46	2,30
20	0,45	47	2,40
21	0,50	48	2,50
22	0,55	49	2,60
23	0,60	50	2,65
24	0,65	51	2,70
25	0,70	52	2,8
26	0,75	53	2,9
27	0,80	54	3,0

**Selection table for drawing dies B2/C3  
(#01430132)**

valid for **ferrous and non-ferrous** material  
(material type necessary for order)

Norm: ERICHSEN

Var.	Thickness s / mm	Var.	Thickness s / mm
1	0,076	43	2,00
2	0,100	44	2,10
3	0,127	45	2,20
4	0,13	46	2,30
5	0,14	47	2,40
6	0,15	48	2,50
7	0,18	49	2,60
8	0,20	50	2,65
9	0,21	51	2,70
10	0,23	52	2,8
11	0,24	53	2,9
12	0,25	54	3,0
13	0,26	55	3,1
14	0,27	56	3,2
15	0,28	57	3,3
16	0,30	58	3,4
17	0,32	59	3,5
18	0,35	60	3,6
19	0,40	61	3,7
20	0,45	62	3,8
21	0,50	63	3,9
22	0,55	64	4,0
23	0,60	65	4,1
24	0,65	66	4,2
25	0,70	67	4,3
26	0,75	68	4,4
27	0,80	69	4,5
28	0,85	70	4,6
29	0,90	71	4,7
30	0,95	72	4,8
31	1,00	73	4,9
32	1,10	74	5,0
33	1,15	75	5,1
34	1,20	76	5,2
35	1,25	77	5,3
36	1,30	78	5,4
37	1,40	79	5,5
38	1,50	80	5,6
39	1,60	81	5,7
40	1,70	82	5,8
41	1,80	83	5,9
42	1,90	84	6,0

**Selection table for drawing dies B2/C3  
(#01430132)**

valid for **aluminium and aluminium alloy**  
Norm: DIN EN 1669

gültig für Clearance ratio <b>1,15 bis 1,52</b>		gültig für Clearance ratio <b>1,34 bis 1,76</b>	
Var.	Blechdicke s / mm	Var.	Blechdicke s / mm
1	3,501 < s ≤ 4,100	1	3,001 < s ≤ 3,500
2	4,101 < s ≤ 5,000	2	3,501 < s ≤ 4,400
3	5,001 < s ≤ 6,000	3	4,401 < s ≤ 5,300

**Selection table for drawing dies B2/C3  
(#01430132)**

valid for **ferrous and non-ferrous** material  
(material type necessary for order)  
Norm: ISO 11531

Var.	Blechdicke s / mm	Var.	Blechdicke s / mm
1	0,1 < s ≤ 0,2	4	0,8 < s ≤ 1,6
2	0,2 < s ≤ 0,4	5	1,6 < s ≤ 3,0
3	0,4 < s ≤ 0,8		

**Selection table for drawing dies B3/C4  
(#01480132)**

valid for **ferrous and non-ferrous** material  
(material type necessary for order)  
Norm: ERICHSEN  
(only for model 142-40)

Var.	Blechdicke s / mm	Var.	Blechdicke s / mm
1	0,076	31	1,00
2	0,100	32	1,10
3	0,127	33	1,15
4	0,13	34	1,20
5	0,14	35	1,25
6	0,15	36	1,30
7	0,18	37	1,40
8	0,20	38	1,50
9	0,21	39	1,60
10	0,23	40	1,70
11	0,24	41	1,80
12	0,25	42	1,90
13	0,26	43	2,00
14	0,27	44	2,10
15	0,28	45	2,20
16	0,30	46	2,30
17	0,32	47	2,40
18	0,35	48	2,50
19	0,40	49	2,60
20	0,45	50	2,65
21	0,50	51	2,70
22	0,55	52	2,8
23	0,60	53	2,9
24	0,65	54	3,0
25	0,70	55	3,1
26	0,75	56	3,2
27	0,80	57	3,3
28	0,85	58	3,4
29	0,90	59	3,5
30	0,95		

**Selection table for drawing dies for square cups 40x40 (#01530132)**

valid for **ferrous and non-ferrous** material  
(material type necessary for order)  
Norm: ERICHSEN

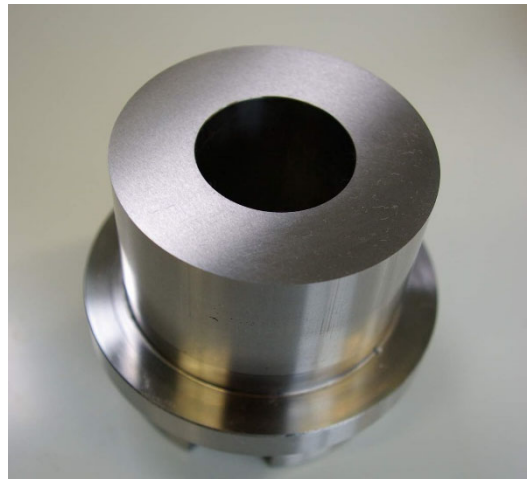
Var.	Blechdicke s / mm	Var.	Blechdicke s / mm
1	0,10	20	0,85
2	0,15	21	0,90
3	0,20	22	0,95
4	0,22	23	1,00
5	0,23	24	1,10
6	0,24	25	1,20
7	0,25	26	1,25
8	0,26	27	1,30
9	0,30	28	1,40
10	0,35	29	1,50
11	0,40	30	1,60
12	0,45	31	1,70
13	0,50	32	1,80
14	0,55	33	1,90
15	0,60	34	2,00
16	0,65	35	2,30
17	0,70	36	2,50
18	0,75	37	2,60
19	0,80	38	3,00

**Selection table for blanking die ring (#08690132)**

valid for **ferrous and non-ferrous** material  
Norm: ISO 16630

Var.	Blechdicke s / mm	Var.	Blechdicke s / mm
1	$1,2 \leq s < 1,5$	7	$3,6 \leq s < 4,0$
2	$1,5 \leq s < 1,9$	8	$4,0 \leq s < 4,4$
3	$1,9 \leq s < 2,3$	9	$4,4 \leq s < 4,8$
4	$2,3 \leq s < 2,7$	10	$4,8 \leq s < 5,2$
5	$2,7 \leq s < 3,1$	11	$5,2 \leq s < 5,7$
6	$3,1 \leq s < 3,6$	12	$5,7 \leq s < 6,0$

## Selection table for blanking tools



### **Blanking tool for deep-drawing cups blank cut with punch dia 33 mm (B1):**

- consists of blanking die ring (# 01380132) and blanking punch (01390132)

for ferrous material:

- 55 – 80 mm
- 64 mm recommended
- ISO 11531 approx. 60 mm

for non-ferrous material:

- DIN EN 1669 / 60 or 64 mm

Punching areas for sheet thicknesses of ferrous materials:

- 0,2 – 1,0 mm
- 1,1 – 2,5 mm

Punching areas for sheet thicknesses of non-ferrous materials:

- 0,1 – 0,59 mm
- 0,6 – 1,69 mm
- 1,7 – 3,0 mm

### **Blanking tool for deep-drawing cups blank cut with punch dia 50 mm (B2):**

- consists of blanking die ring (# 01440132) and blanking punch (01450132)

for ferrous material:

- 81 - 120 mm
- 90 mm recommended
- Square cups 40 x 40 approx. 85 mm (blanking punch # 04190132)

Punching areas for sheet thicknesses of ferrous materials:

- 0,2 – 1,0 mm
- 1,1 – 2,0 mm
- 2,1 – 4,0 mm
- 4,1 – 6,0 mm

Punching areas for sheet thicknesses of non-ferrous materials:

- 0,1 – 0,59 mm
- 0,6 – 1,69 mm
- 1,7 – 3,0 mm

**Blanking tool for deep-drawing cups blank cut with punch dia 75 mm (B3):**  
**(only for model 142-40)**

- consists of blanking die ring (# 01490132) and blanking punch (01500132)

for ferrous material:

- 121 - 170 mm
- 90 mm recommended
- Square cups 40 x 40 approx. 85 mm (blanking punch # 04190132)

Punching areas for sheet thicknesses of ferrous materials:

- 0,2 – 1,0 mm
- 1,1 – 2,0 mm
- 2,1 – 4,0 mm
- 4,1 – 6,0 mm

Punching areas for sheet thicknesses of non-ferrous materials:

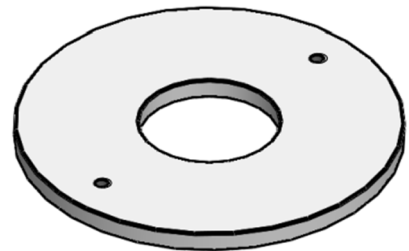
- 0,1 – 0,59 mm
- 0,6 – 1,69 mm
- 1,7 – 3,0 mm

**Wiper rings:**

**Model 142-20**

**Wiper ring (# 30720032)** for a specific punching area:

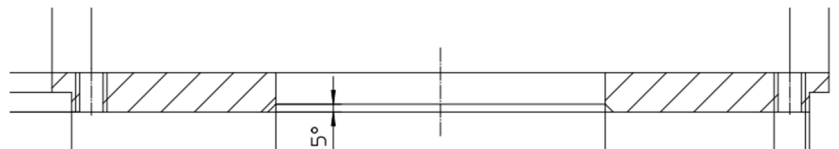
- Ø 50-55mm
- Ø 55-67mm
- Ø 68-80mm
- Ø 80-100mm
- Ø 101-120mm



**Model 142-40**

**Wiper ring (# 30730032)** for a specific punching area

- Ø 55-67mm
- Ø 67-80mm
- Ø 80-100mm
- Ø 100-120mm
- Ø 120-130mm
- Ø 130-140mm
- Ø 140-150mm
- Ø 150-160mm
- Ø 160-170mm



**Further Universal Sheet Metal Testing Machines supplied by ERICHSEN:**

**Electro-hydraulically driven Sheet Metal Testing Machine with Automatic Controls – Model 134**  
(drawing force 120 kN)



**Universal Sheet Metal Testing Machine with Automatic Test Sequence - Model 142-Basic**  
(drawing force 200 kN or 400 kN) – *compact design*



**Universal Sheet Metal Testing Machine with Automatic Test Sequence - Model 145-60-Basic**  
(drawing force 600 kN) – *compact design*

**Universal Sheet Metal Testing Machine for Research and Development - Model 145**  
(drawing force 600 kN or 1000 kN)

**Universal Sheet Metal Testing Machine for Research, Development and In-process Testing - Model 146**  
(drawing force 600 kN or 1000 kN)

