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CUSTOMIZED SOLUTIONS

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HARDNESS CONVERSION TABLES FOR METALS

STEELS AND CAST IRON (HS)

TENSILE N.mm²	TENSILE σ Kg/mm²	VICKERS HV30	BRINELL HB30	For Rolls SHORE D	ROCKWELL C	ROCKWELL D	ROCKWELL A	SUPER ROCKWELL 45N	SUPER ROCKWELL 30N	SUPER ROCKWELL 15N
		1710								
		1663								
		1556								
		1478								
		1400								
		1323								
		1245								
		1160								
		1076								
		1004								
		940		D	68	77	85,5	75,5	84,5	93,3
		903		105	67	76	85	74,5	83,5	93
		870		104	66	75,5	84,5	73	83	92,5
		840		103	65	74,5	84	72	82	92
		813		101	64	74	83,5	71	81	-
		787		99	63	73	83	70	80	91,5
		762		97	62	72,5	82,5	69	79	91
		738		94	61	71,5	81,5	67,5	78,5	90,5
		715		92	60	71	81	66,5	77,5	90
		693		90	59	70	80,5	65,5	76,5	89,5
		672		87	58	69	80	64	75,5	-
		652		84	57	68,5	79,5	63	75	89
		632		81	56	67,5	79	62	74	88,5
		612		79	55	67	78,5	61	73	88
		593		77	54	66	78	59,5	72	87,5
		575	HB30	76	53	65,5	77,5	58,5	71	87
		558		74	52	64,5	77	57,5	70,5	86,5
		542	497	72	51	64	76,5	96	69,5	86
		526	485	70	50	63	76	55	68,5	85,5
		510	475	69	49	62	75,5	54	67,5	85
		495	462	68	48	61,5	74,4	52,5	66,5	84,5
		480	450	67	47	60,5	74	73,5	66	84
1540	157	466	440	65	46	60	73,5	50	65	83,5
1471	150	453	433	64	45	59	73	49	64	83
1432	146	440	423	63	44	58,5	72,5	48	63	82,5
1402	143	428	413	61	43	57,5	72	46,5	62	82
1373	140	416	405	59	42	57	71,5	45,5	61,5	81,5
1334	136	404	395	58	41	56	71	44,5	60,5	81
1304	133	392	387	56	40	55,5	70,5	43	59,5	80,5
1275	130	381	377	55	39	54,5	70	42	58,5	80
1245	127	370	368	54	38	54	69,5	41	57,5	79,5
1216	124	360	359	53	37	53	69	39,5	56,5	79
1177	120	350	350	52	36	52,5	68,5	38,5	56	78,5
1147	117	341	341	51	35	51,5	68	37	55	78
1118	114	332	332	50	34	50,5	67,5	36	54	77
1088	111	323	323	49	33	50	67	35	53	76,5
1059	108	314	314	48	32	49	66,5	33,5	52	76
1030	105	306	306	46	31	48,5	66	32,5	51,5	75,5
1000	102	298	298	45	30	47,5	65,5	31,5	50,5	75
971	99	290	290	44	29	47	65	30	49,5	74,5
951	97	283	283	43	28	46	64,5	29	48,5	74
922	94	276	276	42	27	45,5	64	28	47,5	73,5
902	92	269	269	41	26	44,5	63,5	26,5	47	72,5
873	89	262	262	40	25	44	63	25,5	46	72
853	87	256	256	39	24	43	62,5	24	45	71,5
833	85	250	250	38	23	42,5	62	23	44	71
824	84	244	244	-	22	41,5	61,5	22	43	70,5
804	82	239	239	37	21	41	61	20,5	42	70
784	80	234	234	36	20	40	60	19,5	41,5	69,5
755	77	225	225	35	18,5					
725	74	216	216	34	16,5					
706	72	210	210	33	15	D	A	45N	30N	15N
686	70	205	205	32	14					
667	68	200	200	-	12,5					
657	67	195	195	31	11					
637	65	190	190	-	9,5					
618	63	185	185	SHORE D	8					
608	62	180	180		7					
588	60	176	176		6					
578	59	172	172		4,5					
559	57	169	169		3					
549	56	165	165		2					
539	55	162	162		0					
529	54	159	159							
519	53	156	156							
510	52	153	153							
500	51	150	150		C					
490	50	146	146							
-	-	144	144							
470	48	141	141							
-	-	139	139							
-	-	137	137							
461	47	135	135							
-	-	132	132							
441	45	130	130							
-	-	127	127							
421	43	125	125							
-	-	123	123							
412	42	121	121							
-	-	119	119							
402	41	117	117							
-	-	116	116							
-	-	112	112							
382	39	110	110							
-	-	108	108							
-	-	107	107							
362	37	106	106							
-	-	104	104							
-	-	103	103							
343	35	101	101							
-	-	100	100							
-	-	98	98							
323	33	97	97							
-	-	95	95							
-	-	94	94							
-	-	92	92							
304	31	90	90							
-	-	89	89							
-	-	88	88							
294	30	86	86							
-	-	84	84							
284	29	83	83							
-	-	81	81							
274	28	80	80							
N.mm²	Kg/mm²	HV30	HB30							

SCALE	INDENTER		FORCE
	ROCKWELL		N
HRC	∇ 120°		1471
HRA	∇ 120°		588
HRD	∇ 120°		981
HRB	Ø 1/16"		981
HRE	Ø 1/8"		981
HRF	Ø 1/16"		588
HRG	Ø 1/16"		1471
HRK	Ø 1/8"		1471
	Superficial ROCKWELL		
HR15N	∇ 120°		147
HR30N	∇ 120°		294
HR45N	∇ 120°		441
HR15T	Ø 1/16"		147
HR30T	Ø 1/16"		294
HR45T	Ø 1/16"		441
	BRINELL		
HB 10/3000	ball Ø 10	(HB 30)	29430
HB 5/750	ball Ø 5	(HB 30)	7357
HB 2,5/187,5	ball Ø 2,5	(HB 30)	1839
HB 2,5/62,5	ball Ø 2,5	(HB 10)	613
HB 10/500	ball Ø 10	(HB 5)	4905
HB 5/125	ball Ø 5	(HB 5)	1226
HB 2,5/31,2	ball Ø 2,5	(HB 5)	306
	VICKERS		
HV10	diamond ∇ 136°		981
HV15	diamond ∇ 136°		147
HV30	diamond ∇ 136°		294
HV60	diamond ∇ 136°		588

Minimum thickness measurable

ROCKWELL ∇ Diam

F	HRC					
	20	30	40	50	60	70
HR15N	0.41	0.33	0.26	0.19	0.14	0.09
HR30N	0.69	0.58	0.47	0.36	0.26	0.17
HR45N	0.91	0.77	0.63	0.50	0.37	0.25
HRA	1.0	0.9	0.8	0.7	0.6	0.5
HRC	1.8	1.6	1.4	1.2	1.0	0.8
METALTESTER	0.38	0.32	0.26	0.20	0.14	0.08

Minimum thickness measurable

BRINELL

Ø mm	F N	HB 40	60	80	100	150	200	300	400	500
2,5	1839	(HB / 30)			2.40	1.60	1.20	0.80	0.60	0.48
5	1226	2.0	1.3	1.0	0.80	0.53			(HB / 5)	
10	9810	8.0	5.3	4.0	3.2	2.1	1.6		(HB / 10)	
10	29430	(HB / 30)			9.6	6.3	4.8	3.2	2.4	1.9
METALTESTER		Scale 80-500		0.63	0.53	0.42	0.32	0.22	0.16	0.10
		0.53	0.42	0.32	0.27	0.15	0.10	Scale 40 - 200		

Minimum thickness measurable

VICKERS ∇ Diam

F Kg	HV 20	50	100	200	300	400	600	800	1000
HV0.200	0.19	0.12	0.09	0.06	0.05	0.04	0.04	0.03	0.03
HV1	0.43	0.28	0.19	0.14	0.12	0.10	0.08	0.07	0.06
HV2	0.62	0.39	0.28	0.19	0.16	0.14	0.12	0.10	0.09
HV5	1.0	0.62	0.44	0.31	0.25	0.22	0.18	0.15	0.14
HV10	1.4	0.87	0.62	0.43	0.36	0.31	0.25	0.22	0.19
METALTESTER	0.70	0.60	0.50	0.37	0.32	0.26	0.18	0.08	0.06
METALTESTER/2	0.65	0.55	0.45	0.30	0.28	0.20	0.10	0.06	0.05

NO IRON METALS (SS)

VICKERS HV	BRINELL HB 5	ROCKWELL G	ROCKWELL K	ROCKWELL B	ROCKWELL A	ROCKWELL E	SUPER ROCKWELL 45T	SUPER ROCKWELL 30T	SUPER ROCKWELL 15T
		92							
		91							
		90							
		89							
		88							
		87							
		86							
		85							
		84							
		83							
		82							
		81							
		80							
		79							
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		8							
		7							
		6							
		5							
		4							
		3							
		2							
		1							
		0							
767									
757									
745									
733									
722									
710									
698									
684									
682									
670									
656									
653									
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16									
HV	HB 5								

VICKERS HV	BRINELL HB 5	ROCKWELL G	ROCKWELL K	ROCKWELL B	ROCKWELL A	ROCKWELL E	SUPER ROCKWELL 45T	SUPER ROCKWELL 30T	SUPER ROCKWELL 15T
198	195	82		99	61		72	82	93
195	189	81		98	60		71	81,5	92,3
191	184	79		97	59,5		70	81	-
188	179	77		96	59		69	80,5	92
185	175	76		95	58		68	80	-
182	171	74		94	57,5		67	79	91,5
179	167	73		93	57		66	78,5	-
176	163	72		92	56,5		65,5	78	91
173	160	71		91	56		64,5	77,5	90,5
171	157	70		90	55,5		63,5	77	-
168	154	69		89	55		62	76	90
165	151	68		88	54		61	75,5	89,5
163	148	67		87	53,5		60,5	75	-
160	145	66		86	53		59,5	74,5	89
157	142	65		85	52,5		58,5	74	88,5
156	140	64		84	52		58	73,5	-
153	137	63		83	51		57	73	88
151	135	62		82	50,5		56	72	87,5
149	133	61		81	50		55	71,5	-
147	130	60		80	49,5		54	71	87
145	128	59		79	49		53	70	86,5
142	126	58		78	48,5		52	69,5	-
140	124	57		77	48		51	69	86
138	122	56		76	47		50	68	85,5
136	120	55		75	46,5		49	67,5	-
134	118	54		74	46		48,5	67	85
132	116	53		73	45,5		47	66	-
131	114	52		72	45		46,5	65,5	84
129	112	51		71	44,5		45,5	65	84
126	110	50		70	44		44	64	-
125	109	49		69	43,5		43	63,5	83,5
124	107	48		68	43		42,5	62,5	83
122	106	47		67	42,5		41,5	62	-
120	104	46		66	42		40,5	61,5	82,5
118	102	45		65	41,5		39,5	60,5	82
117	101	44		64	41		38,5	60	-
115	99	43		63	40,5		37,5	59,5	81,5
114	98	42		62	40		36,5	58,5	81
113	96	41		61	39,5		35,5	58	-
112	95	40		60	39		34,5	57	80,5
111	94	39		59	38,5		33,5	56,5	-
109	92	38		58	38		32	56	80
108	91	37		57	37,5		31	55	79,5
107	90	36		56	37		30	54,5	-
106	89	35		55	36,5		29	54	79
105	87	34		54	36		28	53	78,5
104	86	33		53	35,5		27	52,5	-
103	85	32		52	35		26	51,5	78
102	84	31		51	34,5		25	51	77,5
101	83	30		50	34		24	50,5	-
100	82	29		49	33,5		23	49,5	77
98	81	28		48	33		22	49	76,5
97	80	27		47	32,5		20,5	48,5	-
96	79	26		46	32		19,5	47,5	76
-	78	25		45	31,5		18,5	47	75,5
95	77	24		44	31		17	46	-
94	76	23		43	30,5		16	45,5	75
93	75	22		42	30		15,5	45	74,5
92	74	21		41	29,5		14,5	44	-
91	73	20		40	29		13,5	43,5	74
90	72	19		39	28,5		12,5	43	73,5
89	71	18		38	28		11	42	-
88	70	17		37	27,5		10	41,5	73
87	69	16		36	27		9	40,5	72,5
86	68	15		35	26,5			40	-
85	67	14		34	26				
84	66	13		33	25,5				
83	65	12		32	25				
82	64	11		31	24,5				
81	63	10		30	24				
80	62	9		29	23,5				
79	61	8		28	23				
78	60	7		27	22,5				
77	59	6		26	22				
76	58	5		25	21,5				
75	57	4		24	21				
74	56	3		23	20,5				
73	55	2		22	20				
72	54	1		21	19,5				
71	53	0		20	19				
70	52			19	18,5				
69	51			18	18				
68	50			17	17,5				
67	49			16	17				
66	48			15	16,5				
65	47			14	16				
64	46			13	15,5				
63	45			12	15				
62	44			11	14,5				
61	43			10	14				
60	42			9	13,5				
59	41			8	13				
58	40			7	12,5				
57	39			6	12				
56	38			5	11,5				
55	37			4	11				
54	36			3	10,5				
53	35			2	10				
52	34			1	9,5				
51	33			0	9				
50	32				8,5				
49	31				8				
48	30				7,5				
47	29				7				
46	28				6,5				
45	27				6				
44	26				5,5				
43	25				5				
42	24				4,5				
41	23				4				
40	22				3,5				
39	21				3				
38	20				2,5				
37	19				2				
36	18				1,5				
35	17				1				
34	16				0,5				
33	15				0				
32	14								
31	13								
30	12								
29	11								
28	10								
27	9								
26	8								
25	7								
24	6								
23	5								
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20	2								
19	1								
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2									
1									
HV	HB 5								

All the values shown are aproximate only.
This chart is intended primarily as a reference guide.

AFFRI®
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AFFRI, FROM 1954 HARDNESS TESTERS PRODUCTION AND WORLD WIDE SUPPLY

Since 1954 AFFRI® is producing hardness testers combining test loads and innovative devices that make up the AFFRI SYSTEM®. The handling can be mechanical, electro-mechanical, hydro-mechanical or pneumo-mechanical.

The AFFRI SYSTEM® has long surpassed traditional philosophies using dead-weights and elevating screws that can still be used in conventional hardness testers.

The AFFRI SYSTEM® 's patterns are protected, registered and deposited.

An increase in operational performance has already been obtained using closed-loop load control (Patent AFFRI® N. 1175158); this improvement is moderate if compared with the high quality and practical performance levels reached by the AFFRI SYSTEM®.

A further improvement in performance was achieved when AFFRI® built the truly automatic hardness tester for performing Rockwell, Brinell and Vickers tests.

The fully automatic control ensures that the speed remains unchanged throughout the entire test cycle, even in the load-cell version, thanks to the leading technology of AFFRI SYSTEM® (patent pending).

UNITED STATES OF AMERICA National Voluntary Laboratory Accreditation Program USA	**ICELAND** National Accreditation Scheme, 1991
UNITED KINGDOM British Calibration Service (NAMAS), 1968	**BELGIUM** Belgische Kalibratie Organisatie (BIKO)/ Organization Belge d'Etalonnage (OBE), 1986
ITALY Servizio di Taratura in Italia (SIT), 1979	**SWITZERLAND** Swiss Calibration Service (SCS), 1986
IRELAND Irish Laboratory Accreditation Board (ILAB), 1985	**FEDERAL REPUBLIC OF GERMANY** Deutscher Kalibrierdienst (DKD), 1977
NETHERLANDS Netherlands Calibration Service (NKO), 1975	**DENMARK** The national Testing Board of Denmark (STP), 1973
NORWAY Norwegian Calibration Service (NKT), 1987	**SPAIN** Sistema de Calibración Industrial (SCI), 1983
PORTUGAL Portuguese Institute for Quality (IPQ)	**FINLAND** Finnish Measurement Service (MSF), 1980
SWEDEN Swedish Board for Technical Accreditation (SWEDAC), 1975	**FRANCE** Système des Chaines d'étalonnage (BNM), 1971
AUSTRIA Österreichischer Kalibrierdienst ÖVE-ÖIAV (ÖKD), 1968	**GREECE** Ministry of Commerce Metrology Department, 1991

**ALL AFFRI® INSTRUMENTS ARE CONFORM TO INTERNATIONAL STANDARDS.
FULLY CERTIFIABLE BY INTERNATIONAL CALIBRATION LABORATORIES.
(WHERE APPLICABLE)**

INTEGRAL

FULLY AUTOMATIC TESTER

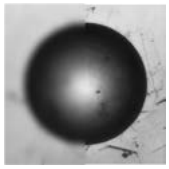
The INTEGRAL hardness testers is a fully motorized system for automatic preloading, loading and measurements.
AFFRI® System hardness testers achieve the highest level of depth accuracy and measurement resolution available.
Thanks to the AFFRI® System, the real indentation measurement is guaranteed without any external interference in any condition.

ONE BUTTON MEASUREMENTS

Just push the start button and the head moves down performing the hardness test cycle in automatic succession without breaching a phase:

1. Automatic contact with the specimen
2. Automatic active sliding clamping
3. Automatic preloading and loading
4. Automatic switching to optic lens
5. Autofocus by image scanning brightness
6. Automatic measure
7. Automatic return stroke at programmed distance

The entire test cycle is complete and the result appears on a large display.



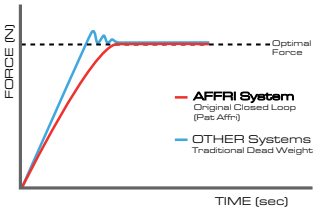
The Auto Focus performs an automatic focus adjustment for the selected optic with precise positioning at any magnification by mean of real image scanning brightness. This system assures high reading accuracy and reduces reading time.

MOTORIZED VERTICAL STROKE 500 mm / 20”

Fully motorized adjustable testing stand up to 500 mm / 20” vertical capacity including automatic contact with test surface from every distance with a single start input (As option up to 700 mm / 28”).
The activation of the test cycle is automatic, it starts when the head makes contact with the specimen which is automatically recognized at any position within the vertical stroke.

LOAD CELL AND CLOSED LOOP

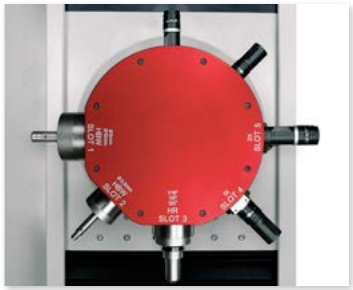
Load forces are applied through load cells and electronically controlled in “Closed Loop” (Pat. AFFRI) with a frequency of 1 kHz. Each load force is automatically programmed and controlled assuring perfect linearity in every range eliminating the problems associated with traditional dead weight system testers. Results are not affected by any structural deflection, misalignment or external vibration. Accurate measurements, even on the first test, eliminate the need for multiple tests. There is no need to perform a second test, the first one is absolutely precise. The R&R (repeatability and reproducibility) data is at the top of its class.

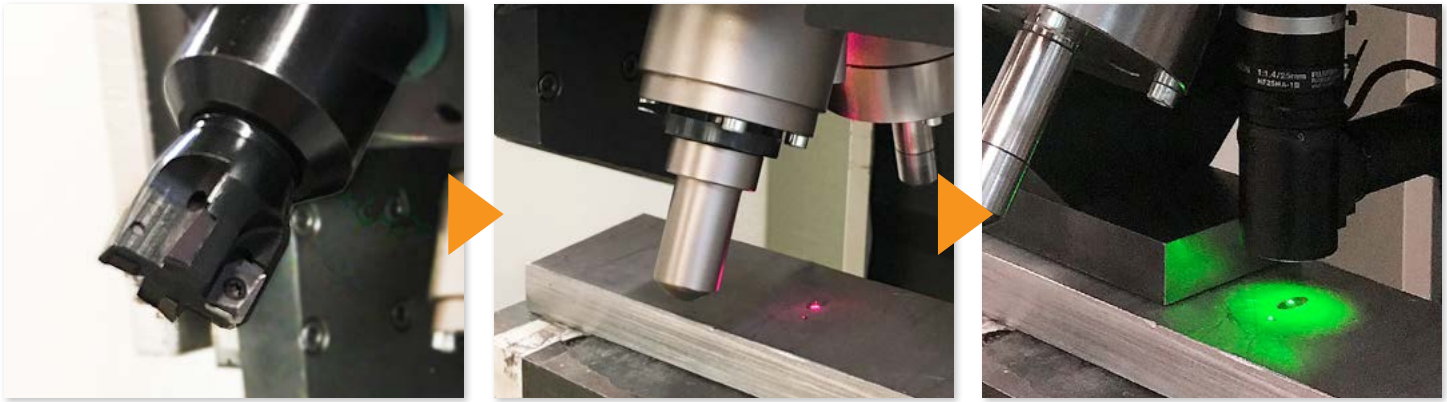


AFFRI®

ALL-IN-ONE AUTOMATIC TURRET

Multi objectives and multi indenters up to 7 positions and more. Complete automation with milling tool. Automatic milling tool for oxidation removal and surface preparation before indenting. Programmable milling thickness for fully automatic process. Secure specimen clamping from milling to the end of the measuring cycle. Laser mirror pointing.

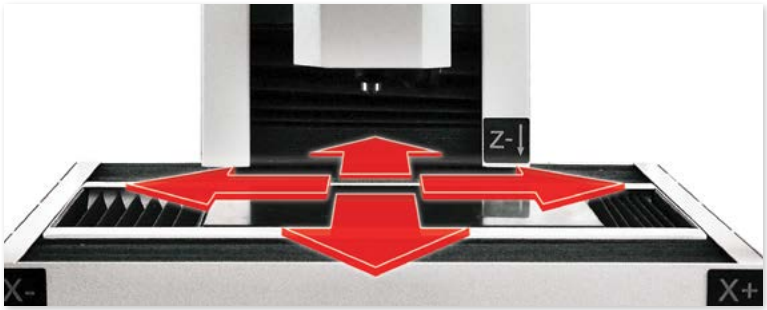


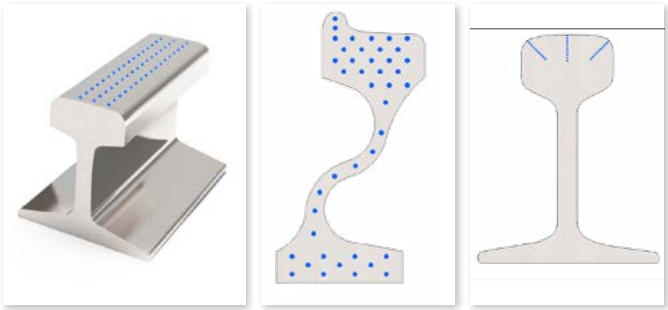


FULLY AUTOMATIC MULTI-INDENTATION CYCLES

Reference points for indentation patterns can be positioned precisely where they are required. The table allows automatic multi-indentation test cycles and CHD on multiple samples with perfect positioning on the entire area, no matter the indentations amount. Everything is automated, freeing users for other tasks and minimizing subjectivity associated with human intervention.

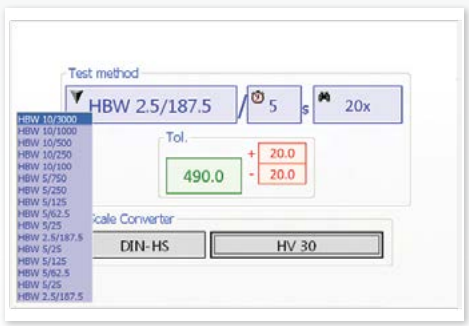
XY MOTORIZED STAGE - Motorized X-Y axis table 200 x 100mm division 0.01 mm combined with automatic start test cycle for hardness case depth. Supported weight 3000kg. (Other dimensions on request)





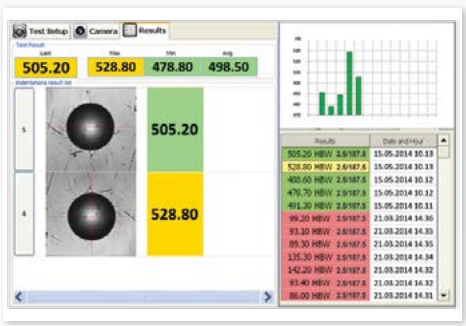
THE MEASURING SOFTWARE

THE SOFTWARE CONTROLS THE WHOLE INSTRUMENT AVOIDING SETTINGS ERRORS OR OPERATORS MISTAKES



Setup the hardness test scales, the load time, the properties of the camera, the test method standards and the conversion scales.

Manage the instrument tools and check if the installed tool is correct for the selected hardness test method.



The software measures the indent and lists it in the results tab with a list of all the performed readings and their associated image.

EASYFLAG 3000

Brinell - Vickers - Rockwell
0,1 to 3000 kgf

EASYFLAG 3000 is a special hardness gauge for Brinell and Rockwell tests, with built-in milling, designed to overcome the typical problems of radial drills, which are not suited to bear loads higher than 3000 kg together with the force for blocking the parts, nor to resist the vibrations caused by milling.
EASYFLAG 3000 is able to perform hardness tests with a completely automatic cycle, thanks to the in-house developed software. It is equipped with a high-resolution camera with autofocus, for the automatic recognition of the indentations.

CARACTERISTICS

- Milling of small parts without requiring brackets
- Possibility of milling parts up to 55 HRC
- Milling depth adjustable from 0 to 1 mm with precision 0.01, up to 3 mm with precision 0.02 mm
- Autofocus
- Test loads: 750, 1000, 3000 kg
- Balls Ø5 and Ø10 mm
- Functional control with a single command
- Reach without bending (max. radius 1 m)
- Solid steel structure (not cast iron)
- Camera with light

VERTICAL MILLING (up to 5mm depth)

INDENTING

READING

EASY PORTAL 3000

Brinell - Vickers - Rockwell
0,1 to 3000 kgf

CNC portal for Brinell tests, 14 m, 4 axes with milling included and automatic test cycle with image analysis.

CARACTERISTICS

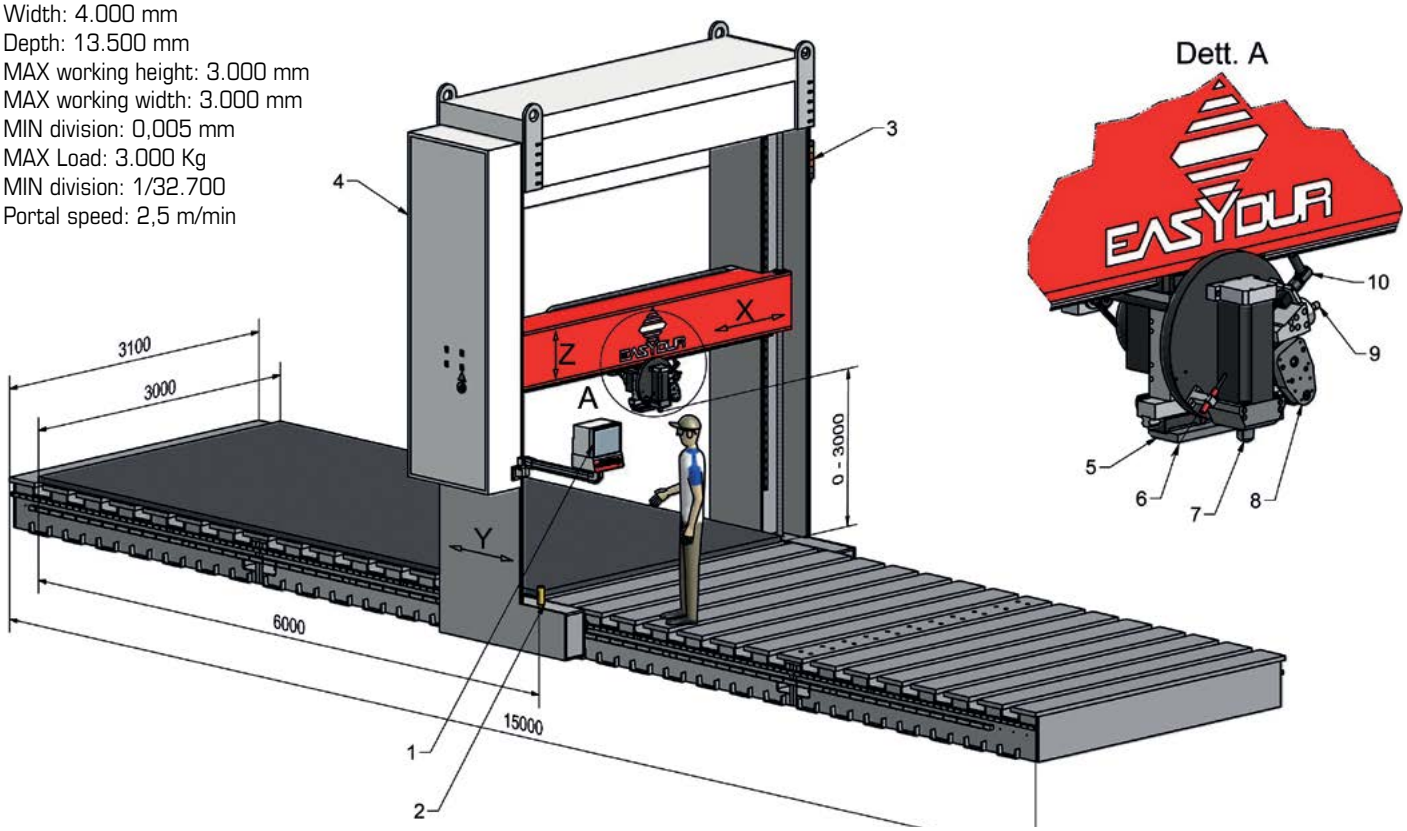
- Rigid and movable head through linear bearing guide motorized head on X-Y-Z and rotating direction
- Fixed table 6000 mm long Portal frame
- Turret to select multiple indenters and multiple objectives equipped with multiple load cell in closed loop
- All parts rotate vertically on the same vertical axis of indenter and optics
- Milling unit programmable with 0,02 mm depth accuracy and programmable finishing surface process
- Remote control and Windows PC
- Remote assistance and remote data transmission

HORIZONTAL MILLING (up to 2mm depth)

INDENTING

READING

- Height: 5.000 mm
- Width: 4.000 mm
- Depth: 13.500 mm
- MAX working height: 3.000 mm
- MAX working width: 3.000 mm
- MIN division: 0,005 mm
- MAX Load: 3.000 Kg
- MIN division: 1/32.700
- Portal speed: 2,5 m/min



Our designers department studies and creates customized solutions for any application with the most advanced and modern technologies which are able to simulate real application and real efficiency.

WARRANTY:

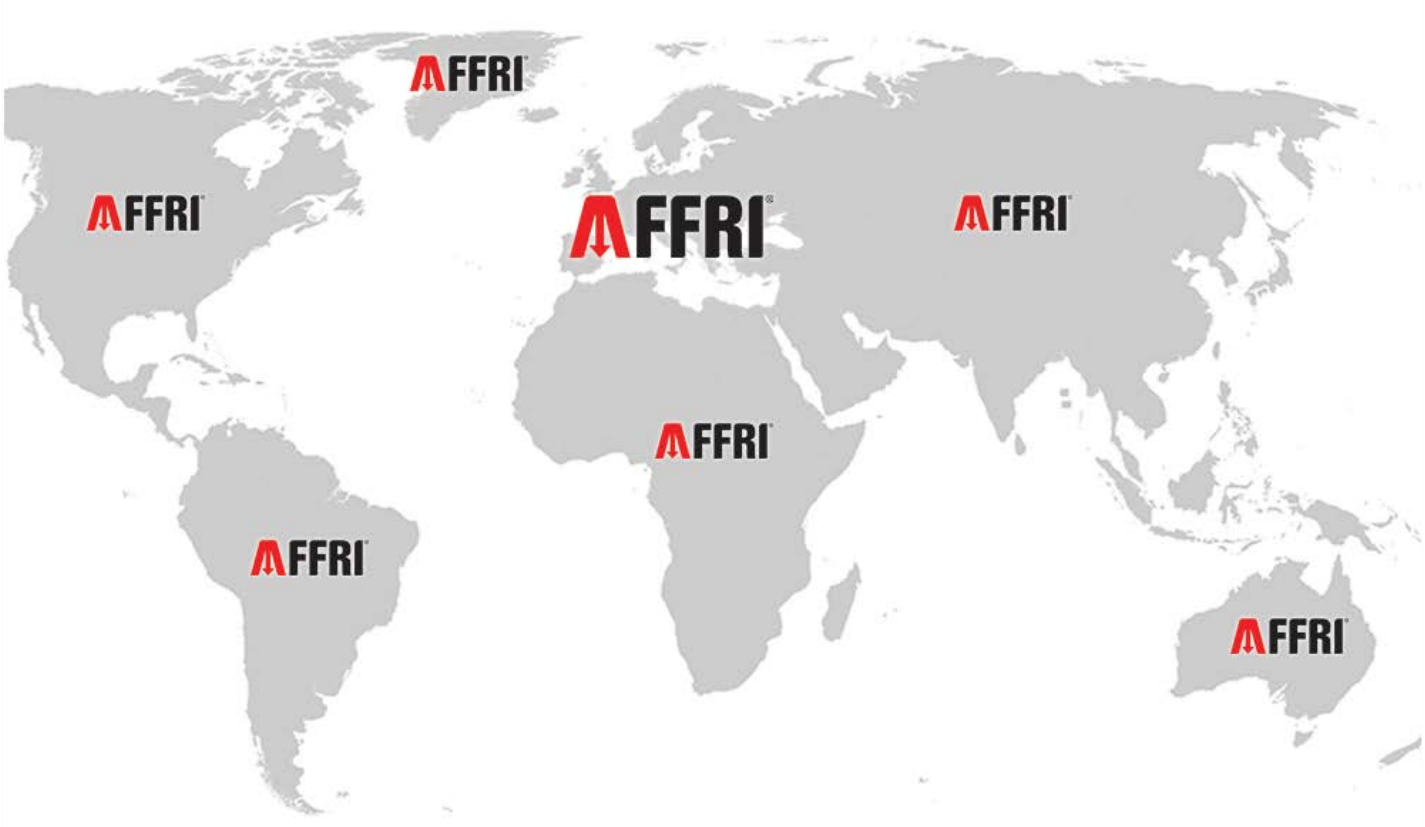
Affri warrantees the instrument for 12 months from date of shipment.
The warranty covers repair or replacement of the defective parts due to defect of construction or design.
The decision to repair or replace will be made by an Affri Engineer only.
The warranty work is performed at Affri Company.
The warranty excludes shipment costs, consumable parts, and commercial items.
Affri is not responsible for consequential damages.
Other warranties are excluded.

ON-SITE SUPPORT:

Our highly qualified service technicians provide on-site support, maintenance and inspection to ensure your equipment is operating at peak performance.
The services includes tester calibration, operator training, software version updates and the diagnose of any technical issues.

REAL TIME SUPPORT:

The remote control connects AFFRI's testers from anywhere in the world with AFFRI's engineers. Our experts can remotely diagnose any technical issues, provide additional operator training and update software version.



NOTES

The information and technical data present in this catalogue are subject to changes. AFFRI® has the right to modify the current data, at any time, in function of the evolution of raw material and new technology.

The installation of the products must be executed following the international standards. AFFRI® and its representatives will not accept any responsibility due to incorrect use, connections or installation. Respect of standards, laws and environments where the products are to be used are under the full responsiblity of the installer.

AFFRI® and its representatives will not accept any responsibility for direct or indirect damage caused to people or things by the products or by consequences of their use.

14.03-PR-GB

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