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LAMPIRAN

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LAMPIRAN

Tabel nilai kekerasan *Rockwell* (HRB) *Al/Fe* berdasarkan variasi *Fe* 5% dengan temperatur tuang 700 ^{0}C

Jarak pengukuran (cm)	Atas (HRB)	$(HRB - \overline{HRB})^2$	Tengah (HRB)	$(HRB - \overline{HRB})^2$	Bawah (HRB)	$(HRB - \overline{HRB})^2$
0,3	42	0.127551	41.5	19.61224	42	18.98469
0,6	43	0.413265	39.5	41.32653	43	28.69898
0,9	43	0.413265	45	0.862245	40	5.556122
1,2	39	11.27041	41.5	19.61224	28	92.98469
1,5	43	0.413265	54	65.14796	27.5	102.8776
1,8	43	0.413265	50	16.57653	40	5.556122
2,1	43.5	1.306122	50	16.57653	43	28.69898
	$\overline{HRB} =$ 42.35714	$\Sigma =$ 2,05102	$\overline{HRB} =$ 45.92857	$\Sigma =$ 25.67347	$\overline{HRB} =$ 37.64286	$\Sigma =$ 40.47959

ATAS

Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = \left[\frac{2{,}05102}{7-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 0.584668$$

TENGAH

Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 2.068553$$

BAWAH

Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 2.597422$$

Tabel nilai kekerasan *Rockwell* (HRB) *Al/Fe* berdasarkan variasi *Fe* 10% dengan temperatur tuang 700 ^{0}C

Jarak pengukuran (cm)	Atas (HRB)	$(HRB - \overline{HRB})^2$	Tengah (HRB)	$(HRB - \overline{HRB})^2$	Bawah (HRB)	$(HRB - \overline{HRB})^2$
0,3	50.5	1.653061	48.5	33.47449	46.5	158.0408
0,6	50	0.617347	45	5.22449	39.5	383.0408
0,9	48	1.47449	38.5	17.7602	86	725.148
1,2	49.5	0.081633	34.5	67.47449	83	572.5765
1,5	47	4.903061	40.5	4.903061	86.5	752.3265
1,8	48.5	0.510204	47	18.36735	30.5	816.3265
2,1	51	3.188776	45	5.22449	41.5	308.7551
	$\overline{HRB} =$ 49.21429	$\Sigma =$ 1.77551	$\overline{HRB} =$ 42.71429	$\Sigma =$ 21.77551	$\overline{HRB} =$ 59.07143	$\Sigma =$ 530.8878

ATAS - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 0.584668$$

TENGAH - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 1.90506$$

BAWAH - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 9.40645$$

Tabel nilai kekerasan *Rockwell* (HRB) *Al/Fe* berdasarkan variasi *Fe* 15% dengan temperatur tuang 700 ^{0}C

Jarak pengukuran (cm)	Atas (HRB)	$(HRB - \overline{HRB})^2$	Tengah (HRB)	$(HRB - \overline{HRB})^2$	Bawah (HRB)	$(HRB - \overline{HRB})^2$
0,3	39	28.69898	42	0.127551	45	27.18878
0,6	45.5	1.306122	44.5	4.591837	39	0.617347
0,9	44.5	0.020408	33.5	78.44898	43	10.33163
1,2	51	44.12755	43	0.413265	20	391.4745
1,5	39	28.69898	47.5	26.44898	42.5	7.367347
1,8	46	2.69898	43	0.413265	43	10.33163
2,1	45.5	1.306122	43	0.413265	46	38.61735
	$\overline{HRB} =$ 44.35714	$\Sigma =$ 15.26531	$\overline{HRB} =$ 42.35714	$\Sigma =$ 15.83673	$\overline{HRB} =$ 39.78571	$\Sigma =$ 69.41837

ATAS - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 1.59506$$

TENGAH - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 1.62464$$

BAWAH - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 3.40143$$

Tabel nilai kekerasan *Rockwell* (HRB) *Al/Fe* berdasarkan variasi *Fe* 5% dengan temperatur tuang 725 ^{0}C

Jarak pengukuran (cm)	Atas (HRB)	$(HRB - \overline{HRB})^2$	Tengah (HRB)	$(HRB - \overline{HRB})^2$	Bawah (HRB)	$(HRB - \overline{HRB})^2$
0,3	42.5	9	43	7.367347	45	0.326531
0,6	39	0.25	43	7.367347	43	2.040816
0,9	41.5	4	41	0.510204	44	0.183673
1,2	36	12.25	37	10.79592	47	6.612245
1,5	37	6.25	40	0.081633	42	5.897959
1,8	38.5	1	40	0.081633	44	0.183673
2,1	42	6.25	38	5.22449	46	2.469388
	$\overline{HRB} =$ 39.5	$\Sigma =$ 5.571429	$\overline{HRB} =$ 40.28571	$\Sigma =$ 4.489796	$\overline{HRB} =$ 44.42857	$\Sigma =$ 2.530612

ATAS - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 0.963624$$

TENGAH - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 0.865043$$

BAWAH - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 0.649437$$

Tabel nilai kekerasan *Rockwell* (HRB) *Al/Fe* berdasarkan variasi *Fe* 10% dengan temperatur tuang 725 ^{0}C

Jarak pengukuran (cm)	Atas (HRB)	$(HRB - \overline{HRB})^2$	Tengah (HRB)	$(HRB - \overline{HRB})^2$	Bawah (HRB)	$(HRB - \overline{HRB})^2$
0,3	45	2.938776	45	4	48	0.617347
0,6	45	2.938776	44	1	48	0.617347
0,9	45	2.938776	43.5	0.25	49	3.188776
1,2	47	0.081633	35	64	45	4.903061
1,5	44.5	4.903061	43	0	45.5	2.938776
1,8	45.5	1.47449	45.5	6.25	46	1.47449
2,1	55	68.65306	45	4	49	3.188776
	$\overline{HRB} =$ 46.71429	$\Sigma =$ 11.9898	$\overline{HRB} =$ 43	$\Sigma =$ 11.35714	$\overline{HRB} =$ 47.21429	$\Sigma =$ 2.418367

ATAS - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 1.413612$$

TENGAH - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 1.375811$$

BAWAH - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 0.634871$$

Tabel nilai kekerasan *Rockwell* (HRB) *Al/Fe* berdasarkan variasi *Fe* 15% dengan temperatur tuang 725 ^{0}C

Jarak pengukuran (cm)	Atas (HRB)	$(HRB - \overline{HRB})^2$	Tengah (HRB)	$(HRB - \overline{HRB})^2$	Bawah (HRB)	$(HRB - \overline{HRB})^2$
0,3	44	18.36735	31	42.25	35	39.5102
0,6	39	0.510204	31.5	36	26.5	218.6173
0,9	45	27.93878	24	182.25	36.5	22.90306
1,2	42	5.22449	90	2756.25	27	204.0816
1,5	26	188.0816	31.5	36	90	2373.082
1,8	39	0.510204	33.5	16	37.5	14.33163
2,1	43	10.79592	21	272.25	36.5	22.90306
	$\overline{HRB} =$ 39.71429	$\Sigma =$ 35.91837	$\overline{HRB} =$ 37.5	$\Sigma =$ 477.2857	$\overline{HRB} =$ 41.28571	$\Sigma =$ 413.6327

ATAS - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 2.446711$$

TENGAH - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 8.918947$$

BAWAH - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 8.302938$$

Tabel nilai kekerasan *Rockwell* (HRB) *Al/Fe* berdasarkan variasi *Fe* 5% dengan temperatur tuang 750 ^{0}C

Jarak pengukuran (cm)	Atas (HRB)	$(HRB - \overline{HRB})^2$	Tengah (HRB)	$(HRB - \overline{HRB})^2$	Bawah (HRB)	$(HRB - \overline{HRB})^2$
0,3	48.5	9.433673	55	34.30612	49	0.510204
0,6	45.5	0.005102	52	8.163265	49	0.510204
0,9	41	19.61224	51	3.44898	48.5	0.045918
1,2	39	41.32653	55	34.30612	50	2.938776
1,5	48	6.612245	55	34.30612	48	0.081633
1,8	47	2.469388	38	124.1633	47	1.653061
2,1	49	12.7551	38	124.1633	46.5	3.188776
	$\overline{HRB} =$ 45.42857	$\Sigma =$ 13.17347	$\overline{HRB} =$ 49.14286	$\Sigma =$ 51.83673	$\overline{HRB} =$ 48.28571	$\Sigma =$ 1.27551

ATAS - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 1.481748$$

TENGAH - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 2.939295$$

BAWAH - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 0.461069$$

Tabel nilai kekerasan *Rockwell* (HRB) *Al/Fe* berdasarkan variasi *Fe* 10% dengan temperatur tuang 750 ^{0}C

Jarak pengukuran (cm)	Atas (HRB)	$(HRB - \overline{HRB})^2$	Tengah (HRB)	$(HRB - \overline{HRB})^2$	Bawah (HRB)	$(HRB - \overline{HRB})^2$
0,3	44	0.045918	52.5	3.188776	47	12.7551
0,6	46	3.188776	48.5	4.903061	48	20.89796
0,9	44	0.045918	49.5	1.47449	43	0.183673
1,2	42	4.903061	50.5	0.045918	32.5	119.4337
1,5	43	1.47449	50.5	0.045918	44.5	1.147959
1,8	43	1.47449	52	1.653061	41	5.897959
2,1	47.5	10.79592	51.5	0.617347	48	20.89796
	$\overline{HRB} =$ 44.21429	$\Sigma =$ 3.132653	$\overline{HRB} =$ 50.71429	$\Sigma =$ 1.704082	$\overline{HRB} =$ 43.42857	$\Sigma =$ 25.88776

ATAS - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 0.722571$$

TENGAH - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 0.532929$$

BAWAH - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 2.077168$$

Tabel nilai kekerasan *Rockwell* (HRB) *Al/Fe* berdasarkan variasi *Fe* 15% dengan temperatur tuang 750 ^{0}C

Jarak pengukuran (cm)	Atas (HRB)	$(HRB - \overline{HRB})^2$	Tengah (HRB)	$(HRB - \overline{HRB})^2$	Bawah (HRB)	$(HRB - \overline{HRB})^2$
0,3	48	147.449	38	51.02041	57.5	17.16327
0,6	49	124.1633	37	66.30612	44.5	78.44898
0,9	57	9.877551	48.5	11.27041	55.5	4.591837
1,2	52.5	58.41327	41	17.16327	52	1.841837
1,5	76.5	267.5561	42.5	6.984694	46	54.12755
1,8	51.5	74.69898	50.5	28.69898	72	347.5561
2,1	86.5	694.699	58.5	178.4133	46	54.12755
	$\overline{HRB} =$ 60.14286	$\Sigma =$ 196.6939	$\overline{HRB} =$ 45.14286	$\Sigma =$ 51.40816	$\overline{HRB} =$ 53.35714	$\Sigma =$ 79.69388

ATAS - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 5.725584$$

TENGAH - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 2.927119$$

BAWAH - Standar Deviasi Skala *Rockwell* (δ HRB)

$$\delta \text{ HRB } = \left[\frac{\sum_{i=1}^{n}(HRB - \overline{HRB})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ HRB } = 3.644491$$

Jarak pengukuran kekerasan spesimen diukur mulai dari sisi tepi permukaan spesimen

Tabel pengujian *bending Al/Fe* temperatur tuang 700°C

no.	Perlakuan	d tebal (mm)	b lebar (mm)	L pjg (mm)	P (N)	S (MPa)
1	Fe 5%	3,0	4,0	45	218,7	205,03
2	Fe 10%	3,0	4,0	45	96,1	90,09
3	Fe 15%	3,0	4,0	45	180,6	169,31

	P (N)	$(P-\bar{P})^2$	S (MPa)	$(S-\bar{S})^2$
Fe 5%	218.7	2869.388	205.03	2522.048
Fe 10%	96.1	4765.601	90.09	4188.678
Fe 15%	180.6	239.2178	169.31	210.25
	$\bar{P} =$ 165.1333	Σ = 2624.736	$\bar{S} =$ 154.81	Σ = 2306.992

Standar Deviasi Skala Tegangan Lentur - S (δ MPa)

$$\delta \text{ MPa } = \left[\frac{\sum_{i=1}^{n}(S-\bar{S})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ MPa } = \left[\frac{2306.992}{3-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ MPa } = 33.96316$$

Tabel pengujian *bending Al/Fe* temperatur tuang 725°C

no.	Perlakuan	d tebal (mm)	b lebar (mm)	L pjg (mm)	P (N)	S (MPa)
1	Fe 5%	3,0	4,0	45	269.8	252.94
2	Fe 10%	3,0	4,0	45	158.6	148.69
3	Fe 15%	3,0	4,0	45	37.24	34.1

	P (N)	$(P-\bar{P})^2$	S (MPa)	$(S-\bar{S})^2$
Fe 5%	269.8	13130,1	252.94	11598,57
Fe 10%	158.6	11.46951	148.69	11.87951
Fe 15%	37.24	13917.71	34.1	12352.84
	$\bar{P} =$ 155.2133	Σ = 9019.76	$\bar{S} =$ 145.2433	Σ = 7987.764

Standar Deviasi Skala Tegangan Lentur - S (δ MPa)

$$\delta \text{ MPa } = \left[\frac{\sum_{i=1}^{n}(S-\bar{S})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ MPa } = \left[\frac{7987.764}{3-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ MPa } = 63.19717$$

Tabel pengujian *bending Al/Fe* temperatur tuang 750°C

no.	Perlakuan	d tebal (mm)	b lebar (mm)	L pjg (mm)	P (N)	S (MPa)
1	Fe 5%	3,0	4,0	45	217	203.44
2	Fe 10%	3,0	4,0	45	160.4	150.38
3	Fe 15%	3,0	4,0	45	162.2	152.06

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	P (N)	$(P-\bar{P})^2$	S (MPa)	$(S-\bar{S})^2$
Fe 5%	217	1378.884	203.44	1211.968
Fe 10%	160.4	378.9511	150.38	332.9408
Fe 15%	162.2	312.1111	152.06	274.4544
	$\bar{P}=$ 179.8667	Σ = 689.9822	$\bar{S}=$ 168.6267	Σ = 606.4545

Standar Deviasi Skala Tegangan Lentur - S (δ MPa)

$$\delta \text{ MPa } = \left[\frac{\sum_{i=1}^{n}(S-\bar{S})^2}{n-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ MPa } = \left[\frac{606.4545}{3-1}\right]^{\frac{1}{2}}$$

$$\delta \text{ MPa } = 17{,}41342$$

$$S = \frac{3\,PL}{4\,bd^2}$$

Dimana :

S = Tegangan Lentur (MPa)

P = Beban / *Load* (N)

L = Panjang Span / *Support Span* (mm)

b = Lebar / *Width* (mm)

d = Tebal/ *Depth* (mm)