

No.	Parameter	Tanggal	
		3 September 2022	8 September 2022
1.	Beban Generator (MW)	12,187 MW	22,759 MW
2.	Laju alir massa Batubara (T/hr)	0,35 T/hr	0,95 T/hr
3.	Laju alir massa <i>Boiler Feed Water</i> (T/hr)	3,042 T/hr	7,13 T/hr
4.	Temperatur <i>Boiler Feed Water in Economizer</i> (°C)	21,75 °C	65,16 °C
5.	Temperatur <i>Boiler Feed Water out Economizer</i> (°C)	21,58 °C	64,67 °C
6.	Laju alir <i>Steam</i> (T/hr)	0,765 T/hr	1,1 T/hr
7.	Temperatur <i>Steam</i> (°C)	39,16 °C	82 °C
8.	Tekanan <i>Steam</i> (MPa)	0,395 MPa	0,7941 MPa
9.	Nilai Kalori Batubara (kCal/kg)	5673 kCal/kg	5673 kCal/kg
10.	Laju Alir Massa Udara Primary Air (m ³ /hr)	-	4108,083 m ³ /hr
11.	Laju Alir Massa Udara Secondary Air (m ³ /hr)	-	-

(Sumber: Distributed Control System Room PT. BEST PLTU Tanjung Enim 3x10 MW, 2022)

No.	Parameter	Tanggal		
		26 Maret 2023	27 Maret 2023	28 Maret 2023
1.	Beban Generator (MW)	62,073 MW	125,605 MW	40,291 MW
2.	Laju alir massa Batubara (T/hr)	4,8975 T/hr	5,7475 T/hr	7,1634 T/hr
3.	Laju alir massa <i>Boiler Feed Water</i> (T/hr)	16,55 T/hr	24,282 T/hr	9,088 T/hr
4.	Temperatur <i>Boiler Feed Water in Economizer</i> (°C)	160,75°C	215,84 °C	95,09 °C
5.	Temperatur <i>Boiler Feed Water out Economizer</i> (°C)	152,67 °C	257,25 °C	86,34 °C
6.	Laju alir <i>Steam</i> (T/hr)	16,21 T/hr	25,81 T/hr	7,16 T/hr
7.	Temperatur <i>Steam</i> (°C)	276,83°C	406,34°C	158,34°C
8.	Tekanan <i>Steam</i> (MPa)	2,878 MPa	4,043 MPa	1,66 MPa
9.	Nilai Kalori Batubara (kCal/kg)	5542 kCal/kg	5542 kCal/kg	5542 kCal/kg
10.	Laju Alir Massa Udara Primary Air (m ³ /hr)	5120,667 m ³ /hr	9712,5 m ³ /hr	4448,167 m ³ /hr
11.	Laju Alir Massa Udara Secondary Air (m ³ /hr)	5727 m ³ /hr	10787,34 m ³ /hr	1751,5 m ³ /hr

(Sumber: Distributed Control System Room PT. BEST PLTU Tanjung Enim 3x10 MW, 2022)

No.	Parameter	Tanggal				
		11 April 2023	12 April 2023	13 April 2023	14 April 2023	15 April 2023
1.	Beban Generator (MW)	122,99 MW	215,073 MW	188,936 MW	219,718 MW	210,199 MW
2.	Laju alir massa Batubara (T/hr)	7,661 T/hr	10,32 T/hr	9,8173 T/hr	10,263 T/hr	10,386 T/hr
3.	Laju alir massa <i>Boiler Feed Water</i> (T/hr)	34,05 T/hr	45,54 T/hr	41,183 T/hr	45,5425 T/hr	43,80 T/hr
4.	Temperatur <i>Boiler Feed Water in Economizer</i> (°C)	259,91 °C	260,25 °C	260,42 °C	259,83 °C	258,91 °C
5.	Temperatur <i>Boiler Feed Water out Economizer</i> (°C)	237,5 °C	257,167 °C	259,25 °C	257,25 °C	256,41 °C
6.	Laju alir <i>Steam</i> (T/hr)	29,29 T/hr	41,97 T/hr	37,78 T/hr	41,62 T/hr	41,18 T/hr
7.	Temperatur <i>Steam</i> (°C)	471,583 °C	480,25 °C	476 °C	480,91 °C	481,41 °C
8.	Tekanan <i>Steam</i> (MPa)	4,898 MPa	5,055 MPa	4,80 MPa	4,67 MPa	4,69 MPa
9.	Nilai Kalori Batubara (kCal/kg)	5618 kCal/kg	5618 kCal/kg	5618 kCal/kg	5618 kCal/kg	5618 kCal/kg
10.	Laju Alir Massa Udara Primary Air (m ³ /hr)	15704,8 m ³ /hr	18197,2 m ³ /hr	18258,5 m ³ /hr	21465 m ³ /hr	18781,9 m ³ /hr
11.	Laju Alir Massa Udara Secondary Air (m ³ /hr)	2623,5 m ³ /hr	11085,1 m ³ /hr	9477,75 m ³ /hr	16422,9 m ³ /hr	8468,5 m ³ /hr

(Sumber: Distributed Control System Room PT. BEST PLTU Tanjung Enim 3x10 MW, 2022)

No.	Parameter	Tanggal				
		16 April 2023	17 April 2023	18 April 2023	19 April 2023	20 April 2023
1.	Beban Generator (MW)	213,228 MW	211,107 MW	209,256 MW	220,981 MW	219,191 MW
2.	Laju alir massa Batubara (T/hr)	10,66 T/hr	9,14 T/hr	9,269 T/hr	9,1545 T/hr	9,475 T/hr
3.	Laju alir massa <i>Boiler Feed Water</i> (T/hr)	43,81 T/hr	43,96 T/hr	41,23 T/hr	46,26 T/hr	45,62 T/hr
4.	Temperatur <i>Boiler Feed Water in Economizer</i> (°C)	259,34 °C	257,75 °C	258,17 °C	262,16 °C	261,5 °C
5.	Temperatur <i>Boiler Feed Water out Economizer</i> (°C)	256,75 °C	256,45 °C	256,41 °C	258,83 °C	258,08 °C
6.	Laju alir <i>Steam</i> (T/hr)	41,52 T/hr	37,77 T/hr	41,43 T/hr	43,50 T/hr	43,33 T/hr
7.	Temperatur <i>Steam</i> (°C)	478,41 °C	475 °C	479,37 °C	481,08 °C	481,58 °C
8.	Tekanan <i>Steam</i> (MPa)	4,67 MPa	4,61 MPa	4,72 MPa	5,07 MPa	4,80 MPa
9.	Nilai Kalori Batubara (kCal/kg)	5618 kCal/kg	5618 kCal/kg	5618 kCal/kg	5618 kCal/kg	5618 kCal/kg
10.	Laju Alir Massa Udara Primary Air (m ³ /hr)	23695,7 m ³ /hr	18751,1 m ³ /hr	18459,7 m ³ /hr	23124 m ³ /hr	15677,4 m ³ /hr
11.	Laju Alir Massa Udara Secondary Air (m ³ /hr)	22521,9 m ³ /hr	10001,6 m ³ /hr	37708,1 m ³ /hr	28073,7 m ³ /hr	22145,3 m ³ /hr

(Sumber: Distributed Control System Room PT. BEST PLTU Tanjung Enim 3x10 MW, 2022)

No.	Parameter	Tanggal				
		21 April 2023	6 Mei 2023	7 Mei 2023	15 Mei 2023	16 Mei 2023
1.	Beban Generator (MW)	53,726 MW	87,412 MW	113,076 MW	126,280 MW	198,931 MW
2.	Laju alir massa Batubara (T/hr)	9,494 T/hr	2,57 T/hr	4,16 T/hr	5,9167 T/hr	6,785 T/hr
3.	Laju alir massa <i>Boiler Feed Water</i> (T/hr)	47,85 T/hr	15,24 T/hr	25,26 T/hr	35,05 T/hr	41,05 T/hr
4.	Temperatur <i>Boiler Feed Water in Economizer</i> (°C)	261,5 °C	109,16 °C	152,33 °C	261,17°C	258,8 °C
5.	Temperatur <i>Boiler Feed Water out Economizer</i> (°C)	257 °C	108,58 °C	151 °C	258,58 °C	237,58 °C
6.	Laju alir <i>Steam</i> (T/hr)	42,11 T/hr	14,01 T/hr	23,46 T/hr	33,86 T/hr	38,78 T/hr
7.	Temperatur <i>Steam</i> (°C)	484,83 °C	201,25 °C	284,25 °C	484,75 °C	474,91 °C
8.	Tekanan <i>Steam</i> (MPa)	4,74 MPa	2,07 MPa	2,83 MPa	4,95 MPa	4,65 MPa
9.	Nilai Kalori Batubara (kCal/kg)	5618 kCal/kg	5654 kCal/kg	5654 kCal/kg	5654 kCal/kg	5654 kCal/kg
10.	Laju Alir Massa Udara Primary Air (m ³ /hr)	15682,4 m ³ /hr	5177,67 m ³ /hr	11366,9 m ³ /hr	28484,7 m ³ /hr	21377,6 m ³ /hr
11.	Laju Alir Massa Udara Secondary Air (m ³ /hr)	49228,6 m ³ /hr	1918,17 m ³ /hr	8263,42 m ³ /hr	9532,83 m ³ /hr	14336 m ³ /hr

(Sumber: Distributed Control System Room PT. BEST PLTU Tanjung Enim 3x10 MW, 2022)

No.	Parameter	Tanggal				
		17 Mei 2023	18 Mei 2023	19 Mei 2023	20 Mei 2023	21 Mei 2023
1.	Beban Generator (MW)	190,155 MW	193,352 MW	207,974 MW	200,684 MW	195,219 MW
2.	Laju alir massa Batubara (T/hr)	6,8841 T/hr	7,2275 T/hr	7,8408 T/hr	6,8375 T/hr	7,0525 T/hr
3.	Laju alir massa <i>Boiler Feed Water</i> (T/hr)	40,31 T/hr	42,22 T/hr	41,66 T/hr	42,26 T/hr	44,98 T/hr
4.	Temperatur <i>Boiler Feed Water in Economizer</i> (°C)	259,16 °C	260,5 °C	259,67 °C	259,6 °C	237,5 °C
5.	Temperatur <i>Boiler Feed Water out Economizer</i> (°C)	256°C	258,75 °C	255,91 °C	257,67 °C	256,16 °C
6.	Laju alir <i>Steam</i> (T/hr)	36,50 T/hr	37,78 T/hr	41,47 T/hr	39,87 T/hr	36,87 T/hr
7.	Temperatur <i>Steam</i> (°C)	475,75 °C	478,25 °C	468,25 °C	476,34 °C	472,5 °C
8.	Tekanan <i>Steam</i> (MPa)	4,77 MPa	4,78 MPa	4,70 MPa	4,73 MPa	4,67 MPa
9.	Nilai Kalori Batubara (kCal/kg)	5654 kCal/kg	5654 kCal/kg	5654 kCal/kg	5654 kCal/kg	5654 kCal/kg
10.	Laju Alir Massa Udara Primary Air (m ³ /hr)	17792,7 m ³ /hr	20899 m ³ /hr	19891 m ³ /hr	15803 m ³ /hr	14371 m ³ /hr
11.	Laju Alir Massa Udara Secondary Air (m ³ /hr)	29320,6 m ³ /hr	17151,9 m ³ /hr	16646 m ³ /hr	13509,4 m ³ /hr	10277,7 m ³ /hr

(Sumber: Distributed Control System Room PT. BEST PLTU Tanjung Enim 3x10 MW, 2022)

No.	Parameter	Tanggal				
		22 Mei 2023	23 Mei 2023	24 Mei 2023	25 Mei 2023	26 Mei 2023
1.	Beban Generator (MW)	199,794 MW	210,480 MW	214,671 MW	211,329 MW	213,181 MW
2.	Laju alir massa Batubara (T/hr)	6,8025 T/hr	7,4591 T/hr	7,5941 T/hr	7,7475 T/hr	7,7325 T/hr
3.	Laju alir massa <i>Boiler Feed Water</i> (T/hr)	40,80 T/hr	41,25 T/hr	42,58 T/hr	42,52 T/hr	42,35 T/hr
4.	Temperatur <i>Boiler Feed Water in Economizer</i> (°C)	258,3 °C	258,4 °C	259,91 °C	259,5 °C	259,83 °C
5.	Temperatur <i>Boiler Feed Water out Economizer</i> (°C)	255,08 °C	255,75 °C	256,5 °C	256,84 °C	257,08 °C
6.	Laju alir <i>Steam</i> (T/hr)	38,70 T/hr	40,89 T/hr	41,72 T/hr	42,14 T/hr	41,46 T/hr
7.	Temperatur <i>Steam</i> (°C)	477,83 °C	472,75 °C	477,41 °C	477,75 °C	477,34 °C
8.	Tekanan <i>Steam</i> (MPa)	4,71 MPa	4,65 MPa	4,76 MPa	4,76 MPa	4,79 MPa
9.	Nilai Kalori Batubara (kCal/kg)	5654 kCal/kg	5654 kCal/kg	5654 kCal/kg	5654 kCal/kg	5654 kCal/kg
10.	Laju Alir Massa Udara Primary Air (m ³ /hr)	16128,3 m ³ /hr	21861 m ³ /hr	21507 m ³ /hr	16312 m ³ /hr	19650 m ³ /hr
11.	Laju Alir Massa Udara Secondary Air (m ³ /hr)	16471,7 m ³ /hr	25991,08 m ³ /hr	26620,5 m ³ /hr	15506,9 m ³ /hr	11301,7 m ³ /hr

(Sumber: Distributed Control System Room PT. BEST PLTU Tanjung Enim 3x10 MW, 2022)

No.	Parameter	Tanggal				
		27 Mei 2023	28 Mei 2023	29 Mei 2023	30 Mei 2023	31 Mei 2023
1.	Beban Generator (MW)	215,614 MW	202,153 MW	210,174 MW	213,038 MW	213,776 MW
2.	Laju alir massa Batubara (T/hr)	7,5358 T/hr	7,6608 T/hr	7,6975T/hr	7,6841 T/hr	7,6825 T/hr
3.	Laju alir massa <i>Boiler Feed Water</i> (T/hr)	42,43 T/hr	41,77 T/hr	42,07 T/hr	43,06 T/hr	43,66 T/hr
4.	Temperatur <i>Boiler Feed Water in Economizer</i> (°C)	258,7 °C	258,1 °C	259,08 °C	259,7 °C	260,6 °C
5.	Temperatur <i>Boiler Feed Water out Economizer</i> (°C)	259 °C	256,34 °C	256,67 °C	257,25 °C	257,25 °C
6.	Laju alir <i>Steam</i> (T/hr)	40,28 T/hr	41,32 T/hr	41,62 T/hr	40,58 T/hr	41,50 T/hr
7.	Temperatur <i>Steam</i> (°C)	476,25 °C	474,08 °C	474,25 °C	477,41 °C	440,75 °C
8.	Tekanan <i>Steam</i> (MPa)	4,72 MPa	4,68 MPa	4,68 MPa	4,75 MPa	4,78 MPa
9.	Nilai Kalori Batubara (kCal/kg)	5654 kCal/kg	5654 kCal/kg	5654 kCal/kg	5654 kCal/kg	5654 kCal/kg
10.	Laju Alir Massa Udara Primary Air (m ³ /hr)	19650 m ³ /hr	19851 m ³ /hr	20003 m ³ /hr	18157 m ³ /hr	17910 m ³ /hr
11.	Laju Alir Massa Udara Secondary Air (m ³ /hr)	11301,7 m ³ /hr	24140 m ³ /hr	19710,9 m ³ /hr	22356,8 m ³ /hr	24541,8 m ³ /hr

(Sumber: Distributed Control System Room PT. BEST PLTU Tanjung Enim 3x10 MW, 2022)



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No. Dok : QF : LBTE : 5.10 : 01 : 00 : 05
 Revisi : 0
 Halaman : 1 dari 1

LAPORAN PENGUJIAN BATUBARA

No. Laporan : 6730 / T / 252231000L / PR.01.09 / IX / 2022
 Nama Pelanggan : PLTU 3 X 10 MW
 Alamat : Tanjung Enim

Tanggal : 21 September 2022

No. Laporan : 093 / V / 23160 / PLTU - TE / III / 2022
 Tanggal : 20 September 2022

No. Urut	IDENTITAS CONTOH	TANGGAL			HASIL PENGUJIAN												KETERANGAN **)
		PENGAMBILAN	TERIMA	PENGUJIAN	TM *)	M *)	Ash *)		VM *)		FC		TS *)		GCV *) (Cal/gr)		
					% (ar)	% (adb)	% (adb)	% (ar)	% (adb)	% (ar)	% (adb)	% (ar)	% (adb)	% (ar)	(adb)	(ar)	
1	63.149.09.2022	01 s/d 20 Sept 2022	20-Sep-22	21-Sep-22	16.68	8.60	5.10	5.38	40.70	37.10	42.60	38.83	0.59	0.54	5,673	5,171	Coal Feeder PLTU 3 x 10 MW
<p>Catatan :</p> <ul style="list-style-type: none"> - Hasil Analisis <i>Normal Test</i> - Parameter Mad : Analisis Moisture Air Dry , Acuan : (BS ISO 11722:2013) - Parameter ASH : Analisis Ash Content , Acuan : (BS ISO 1171:2010 / ASTM-D7582-15) - Parameter VM : Analisis Volatile Matter , Acuan : (BS ISO 562:2010 / ASTM-D7582-15) - Parameter GCV : Analisis Nilai Kalori Gross , Acuan : (BS/ISO 1928:2009 / ASTM-D5865-13) - Parameter TM : Analisis Total Moisture , Acuan : (BS.1016 part 1.1973 / ASTM-D3302-07) - Parameter TS : Analisis Total Sulfur , Acuan : (BS/ ISO 19579:2006 / ASTM-D4239-14) - Parameter FC : Analisis Fixed Carbon , Acuan : Perhitungan <p>- Laporan Pengujian ini dinyatakan telah divalidasi secara memadai oleh personel yang berwenang pada saat didistribusikan melalui transmisi e-Mail.</p> <p>- User name personel pengirim sama dengan personel yang memvalidasi laporan ini.</p> <p>- Laporan pengujian dan/atau sertifikat ini hanya melaporkan keadaan pada saat pengujian dilakukan dan diterbitkan dengan itikad baik tanpa prasangka.</p> <p>- Laporan pengujian ini tidak boleh digandakan sebagian/sepotong-sepotong, kecuali penggandaan secara lengkap dengan persetujuan secara tertulis oleh Laboratorium Pengujian PTBA Tanjung Enim.</p> <p>- Ketidaksihonestan mengenai hasil analisis ini dapat menghubungi Laboratorium Pengujian pada kesempatan pertama.</p> <p>*) Parameter yang sudah diakreditasi</p> <p>**) Lokasi pengambilan contoh dan Subkontraktor yang berkompeten, dll.</p>																	
<p>Telah divalidasi oleh :</p> <p>Irvan Agung L. (Spv. Preparasi & Analisis Batubara A-D)</p>																	

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LAPORAN PENGUJIAN BATUBARA

No. Laporan : 1566 / T / 252231000L / PR.01.09 / III / 2023
 Nama Pelanggan : PLTU 3X10 MW Tanjung Enim
 Alamat : Tanjung Enim

Tanggal : 21 Maret 2023

No. Laporan : 099 / III / 23160 / PLTU-TE / III / 2023
 Tanggal : 20 Maret 2023

No. Urut	IDENTITAS CONTOH	TANGGAL			HASIL PENGUJIAN										KETERANGAN **)		
		PENGAMBILAN	TERIMA	PENGUJIAN	TM *)		Ash *)		VM *)		FC		TS *)			GCV *) (Cal/gr)	
					% (ar)	% (adb)	% (adb)	% (ar)	% (adb)	% (ar)	% (adb)	% (ar)	% (adb)	% (ar)		(adb)	(ar)
1	63. 031. 03. 2023	01 s/d 20 Maret 2023	20-Mar-23 Jam : 09.30 WIB	21-Mar-23	27.1	14.8	6.7	5.7	37.2	31.8	41.3	35.3	0.50	0.43	5,542	4,741	PLTU / Tanjung Enim 3x10 MW Coal Feeder Jam : 08.00 Wib
<p>Catatan :</p> <ul style="list-style-type: none"> - Hasil Analisis <i>Normal Test</i> - Parameter Mad : Analisis <i>Moisture Air Dry</i> , Acuan : (BS ISO 11722:2013) - Parameter ASH : Analisis <i>Ash Content</i> , Acuan : (BS ISO 1171:2010 / ASTM-D7582-15) - Parameter VM : Analisis <i>Volatile Matter</i> , Acuan : (BS ISO 562:2010 / ASTM-D7582-15) - Parameter GCV : Analisis <i>Nilai Kalori Gross</i> , Acuan : (BS/ISO 1928:2009 / ASTM-D5865-13) - Parameter TM : Analisis <i>Total Moisture</i> , Acuan : (BS.1016 part 1.1973 / ASTM-D3302-07) - Parameter TS : Analisis <i>Total Sulfur</i> , Acuan : (BS/ ISO 19579:2006 /ASTM-D4239-14) - Parameter FC : Analisis <i>Fixed Carbon</i> , Acuan : <i>Perhitungan</i> <p>- Laporan Pengujian ini dinyatakan telah divalidasi secara memadai oleh personel yang berwenang pada saat didistribusikan melalui trnsmsisi <i>e-Mail</i>. - User name personel pengirim sama dengan personel yang memvalidasi laporan ini. - Laporan pengujian dan/atau sertifikat ini hanya melaporkan keadaan pada saat pengujian dilakukan dan diterbitkan dengan itikad baik tanpa prasangka. - Laporan pengujian ini tidak boleh digandakan sebagian/sepotong-sepotong, kecuali penggantian secara lengkap dengan persetujuan secara tertulis oleh Laboratorium Pengujian PTBA Tanjung Enim. - Ketidaksesuaian mengenai hasil analisis ini dapat menghubungi Laboratorium Pengujian pada kesempatan pertama.</p> <p>*) Parameter yang sudah diakreditasi **) Lokasi pengambilan contoh dan Subkontraktor yang berkompeten, dll.</p>																	
<p>Telah divalidasi oleh :</p> <p>Farizki Arif. (Pgs. Spv. Preparasi & Analisis Batubara A-D)</p>																	

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LAPORAN PENGUJIAN BATUBARA

No. Laporan : 2146 / T / 252231000L / PR.01.09 / IV / 2023
 Nama Pelanggan : AM. Kendali Mutu
 Alamat : Tanjung Enim

Tanggal : 21 April 2023

No. Laporan : 100 / IV / 23160 / PLTU-TE / III / 2023
 Tanggal : 19 April 2023

No. Urut	IDENTITAS CONTOH	TANGGAL			HASIL PENGUJIAN												KETERANGAN **)		
		PENGAMBILAN	TERIMA	PENGUJIAN	TM *)	M *)	Ash *)		VM *)		FC		TS *)		GCV *) (Cal/gr)				
					% (ar)	% (adb)	% (adb)	% (ar)	% (adb)	% (ar)	% (adb)	% (ar)	% (adb)	% (ar)	(adb)	(ar)			
1	63. 039. 03. 2023	01 s.d 19 April 2023	19-Apr-23 Jam : 10.35 WIB	20-Apr-23	23.00	9.79	8.50	7.26	40.70	34.74	100.00	100.00	41.01	35.00	0.54	0.46	5.618	4.795	PLTU / Tanjung Enim 3x10 MW Coal Feed Jam : 08.00 Wib

Catatan :

- Hasil Analisis *Normal Test*
- Parameter Mad : Analisis *Moisture Air Dry* , Acuan : (BS ISO 11722:2013)
- Parameter ASH : Analisis *Ash Content* , Acuan : (BS ISO 1171:2010 / ASTM-D7582-15)
- Parameter VM : Analisis *Volatile Matter* , Acuan : (BS ISO 562:2010 / ASTM-D7582-15)
- Parameter GCV : Analisis *Nilai Kalori Gross* , Acuan : (BS/ISO 1928:2009 / ASTM-D5865-13)
- Parameter TM : Analisis *Total Moisture* , Acuan : (BS.1016 part 1.1973 / ASTM-D3302-07)
- Parameter TS : Analisis *Total Sulfur* , Acuan : (BS/ ISO 19579:2006 -ASTM-D4239-14)
- Parameter FC : Analisis *Fixed Carbon* , Acuan : Perhitungan
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- *) Parameter yang sudah diakreditasi
- **) Lokasi pengambilan contoh dan Subkontraktor yang berkompeten, dll.

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Kadri. (Spv. Preparasi & Analisis Batubara A-D)



PT. BUKIT ASAM, TBK
 LABORATORIUM PENGUJI BATUBARA
 JL. Parigi No. 01 Tanjung Enim 31716
 Telp. (0734) 451202/451206 Ext. 2924, 2925, Fax.(0734) 451095/451099

No. Dok : QF : LBTE : 5.10 : 01 : 00 : 05
 Revisi : 0
 Halaman : 1 dari 1

LAPORAN PENGUJIAN BATUBARA

No. Laporan : 2644 / T / 252231000L / PR.01.09 / V / 2023
 Nama Pelanggan : AM. Kendali Mutu
 Alamat : Tanjung Enim

Tanggal : 17 Mei 2023

No. Laporan : 101 / V / 23160 / PLTU-TE / III / 2023
 Tanggal : 16 Mei 2023

No. Urut	IDENTITAS CONTOH	TANGGAL			HASIL PENGUJIAN												KETERANGAN **)
		PENGAMBILAN	TERIMA	PENGUJIAN	TM *)	M *)	Ash *)		VM *)		FC		TS *)		GCV *) (Cal/gr)		
					% (ar)	% (adb)	%(adb)	% (ar)	%(adb)	% (ar)	%(adb)	% (ar)	%(adb)	% (ar)	(adb)	(ar)	
1	63. 040. 05. 2023	01 s.d 16 Mei 2023	16-May-23 Jam : 11.00 WIB	17-May-23	22.67	13.82	5.95	5.34	40.10	35.98	40.13	36.01	0.23	0.21	5.654	5.073	PLTU / Tanjung Enim 3x10 MW Coal Feed Jam : 08.00 Wib

Catatan :

- Hasil Analisis Normal Test

- Parameter Mad : Analisis Moisture Air Dry , Acuan : (BS ISO 11722:2013)
- Parameter ASH : Analisis Ash Content , Acuan : (BS ISO 1171:2010 / ASTM-D7582-15)
- Parameter VM : Analisis Volatile Matter , Acuan : (BS ISO 562:2010 / ASTM-D7582-15)
- Parameter GCV : Analisis Nilai Kalori Gross , Acuan : (BS/ISO 1928:2009 / ASTM-D5865-13)
- Parameter TM : Analisis Total Moisture , Acuan : (BS.1016 part 1.1973 / ASTM-D3302-07)
- Parameter TS : Analisis Total Sulfur , Acuan : (BS/ ISO 19579:2006 -ASTM-D4239-14)
- Parameter FC : Analisis Fixed Carbon , Acuan : Perhitungan

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- Ketidaksesuaian mengenai hasil analisis ini dapat menghubungi Laboratorium Pengujian pada kesempatan pertama.

*) Parameter yang sudah diakreditasi

**) Lokasi pengambilan contoh dan Subkontraktor yang berkompeten, dll.

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TABLE A-2

Properties of Saturated Water (Liquid–Vapor): Temperature Table

Pressure Conversions:
1 bar = 0.1 MPa
= 10² kPa

Temp. °C	Press. bar	Specific Volume m ³ /kg		Internal Energy kJ/kg		Enthalpy kJ/kg			Entropy kJ/kg · K		Temp. °C
		Sat. Liquid <i>v_f</i> × 10 ³	Sat. Vapor <i>v_g</i>	Sat. Liquid <i>u_f</i>	Sat. Vapor <i>u_g</i>	Sat. Liquid <i>h_f</i>	Evap. <i>h_{fg}</i>	Sat. Vapor <i>h_g</i>	Sat. Liquid <i>s_f</i>	Sat. Vapor <i>s_g</i>	
.01	0.00611	1.0002	206.136	0.00	2375.3	0.01	2501.3	2501.4	0.0000	9.1562	.01
4	0.00813	1.0001	157.232	16.77	2380.9	16.78	2491.9	2508.7	0.0610	9.0514	4
5	0.00872	1.0001	147.120	20.97	2382.3	20.98	2489.6	2510.6	0.0761	9.0257	5
6	0.00935	1.0001	137.734	25.19	2383.6	25.20	2487.2	2512.4	0.0912	9.0003	6
8	0.01072	1.0002	120.917	33.59	2386.4	33.60	2482.5	2516.1	0.1212	8.9501	8
10	0.01228	1.0004	106.379	42.00	2389.2	42.01	2477.7	2519.8	0.1510	8.9008	10
11	0.01312	1.0004	99.857	46.20	2390.5	46.20	2475.4	2521.6	0.1658	8.8765	11
12	0.01402	1.0005	93.784	50.41	2391.9	50.41	2473.0	2523.4	0.1806	8.8524	12
13	0.01497	1.0007	88.124	54.60	2393.3	54.60	2470.7	2525.3	0.1953	8.8285	13
14	0.01598	1.0008	82.848	58.79	2394.7	58.80	2468.3	2527.1	0.2099	8.8048	14
15	0.01705	1.0009	77.926	62.99	2396.1	62.99	2465.9	2528.9	0.2245	8.7814	15
16	0.01818	1.0011	73.333	67.18	2397.4	67.19	2463.6	2530.8	0.2390	8.7582	16
17	0.01938	1.0012	69.044	71.38	2398.8	71.38	2461.2	2532.6	0.2535	8.7351	17
18	0.02064	1.0014	65.038	75.57	2400.2	75.58	2458.8	2534.4	0.2679	8.7123	18
19	0.02198	1.0016	61.293	79.76	2401.6	79.77	2456.5	2536.2	0.2823	8.6897	19
20	0.02339	1.0018	57.791	83.95	2402.9	83.96	2454.1	2538.1	0.2966	8.6672	20
21	0.02487	1.0020	54.514	88.14	2404.3	88.14	2451.8	2539.9	0.3109	8.6450	21
22	0.02645	1.0022	51.447	92.32	2405.7	92.33	2449.4	2541.7	0.3251	8.6229	22
23	0.02810	1.0024	48.574	96.51	2407.0	96.52	2447.0	2543.5	0.3393	8.6011	23
24	0.02985	1.0027	45.883	100.70	2408.4	100.70	2444.7	2545.4	0.3534	8.5794	24
25	0.03169	1.0029	43.360	104.88	2409.8	104.89	2442.3	2547.2	0.3674	8.5580	25
26	0.03363	1.0032	40.994	109.06	2411.1	109.07	2439.9	2549.0	0.3814	8.5367	26
27	0.03567	1.0035	38.774	113.25	2412.5	113.25	2437.6	2550.8	0.3954	8.5156	27
28	0.03782	1.0037	36.690	117.42	2413.9	117.43	2435.2	2552.6	0.4093	8.4946	28
29	0.04008	1.0040	34.733	121.60	2415.2	121.61	2432.8	2554.5	0.4231	8.4739	29
30	0.04246	1.0043	32.894	125.78	2416.6	125.79	2430.5	2556.3	0.4369	8.4533	30
31	0.04496	1.0046	31.165	129.96	2418.0	129.97	2428.1	2558.1	0.4507	8.4329	31
32	0.04759	1.0050	29.540	134.14	2419.3	134.15	2425.7	2559.9	0.4644	8.4127	32
33	0.05034	1.0053	28.011	138.32	2420.7	138.33	2423.4	2561.7	0.4781	8.3927	33
34	0.05324	1.0056	26.571	142.50	2422.0	142.50	2421.0	2563.5	0.4917	8.3728	34
35	0.05628	1.0060	25.216	146.67	2423.4	146.68	2418.6	2565.3	0.5053	8.3531	35
36	0.05947	1.0063	23.940	150.85	2424.7	150.86	2416.2	2567.1	0.5188	8.3336	36
38	0.06632	1.0071	21.602	159.20	2427.4	159.21	2411.5	2570.7	0.5458	8.2950	38
40	0.07384	1.0078	19.523	167.56	2430.1	167.57	2406.7	2574.3	0.5725	8.2570	40
45	0.09593	1.0099	15.258	188.44	2436.8	188.45	2394.8	2583.2	0.6387	8.1648	45

H₂O

TABLE A-2

(Continued)

Temp. °C	Press. bar	Specific Volume m ³ /kg		Internal Energy kJ/kg		Enthalpy kJ/kg			Entropy kJ/kg · K		Temp. °C
		Sat. Liquid $v_f \times 10^3$	Sat. Vapor v_g	Sat. Liquid u_f	Sat. Vapor u_g	Sat. Liquid h_f	Evap. h_{fg}	Sat. Vapor h_g	Sat. Liquid s_f	Sat. Vapor s_g	
50	.1235	1.0121	12.032	209.32	2443.5	209.33	2382.7	2592.1	.7038	8.0763	50
55	.1576	1.0146	9.568	230.21	2450.1	230.23	2370.7	2600.9	.7679	7.9913	55
60	.1994	1.0172	7.671	251.11	2456.6	251.13	2358.5	2609.6	.8312	7.9096	60
65	.2503	1.0199	6.197	272.02	2463.1	272.06	2346.2	2618.3	.8935	7.8310	65
70	.3119	1.0228	5.042	292.95	2469.6	292.98	2333.8	2626.8	.9549	7.7553	70
75	.3858	1.0259	4.131	313.90	2475.9	313.93	2321.4	2635.3	1.0155	7.6824	75
80	.4739	1.0291	3.407	334.86	2482.2	334.91	2308.8	2643.7	1.0753	7.6122	80
85	.5783	1.0325	2.828	355.84	2488.4	355.90	2296.0	2651.9	1.1343	7.5445	85
90	.7014	1.0360	2.361	376.85	2494.5	376.92	2283.2	2660.1	1.1925	7.4791	90
95	.8455	1.0397	1.982	397.88	2500.6	397.96	2270.2	2668.1	1.2500	7.4159	95
100	1.014	1.0435	1.673	418.94	2506.5	419.04	2257.0	2676.1	1.3069	7.3549	100
110	1.433	1.0516	1.210	461.14	2518.1	461.30	2230.2	2691.5	1.4185	7.2387	110
120	1.985	1.0603	0.8919	503.50	2529.3	503.71	2202.6	2706.3	1.5276	7.1296	120
130	2.701	1.0697	0.6685	546.02	2539.9	546.31	2174.2	2720.5	1.6344	7.0269	130
140	3.613	1.0797	0.5089	588.74	2550.0	589.13	2144.7	2733.9	1.7391	6.9299	140
150	4.758	1.0905	0.3928	631.68	2559.5	632.20	2114.3	2746.5	1.8418	6.8379	150
160	6.178	1.1020	0.3071	674.86	2568.4	675.55	2082.6	2758.1	1.9427	6.7502	160
170	7.917	1.1143	0.2428	718.33	2576.5	719.21	2049.5	2768.7	2.0419	6.6663	170
180	10.02	1.1274	0.1941	762.09	2583.7	763.22	2015.0	2778.2	2.1396	6.5857	180
190	12.54	1.1414	0.1565	806.19	2590.0	807.62	1978.8	2786.4	2.2359	6.5079	190
200	15.54	1.1565	0.1274	850.65	2595.3	852.45	1940.7	2793.2	2.3309	6.4323	200
210	19.06	1.1726	0.1044	895.53	2599.5	897.76	1900.7	2798.5	2.4248	6.3585	210
220	23.18	1.1900	0.08619	940.87	2602.4	943.62	1858.5	2802.1	2.5178	6.2861	220
230	27.95	1.2088	0.07158	986.74	2603.9	990.12	1813.8	2804.0	2.6099	6.2146	230
240	33.44	1.2291	0.05976	1033.2	2604.0	1037.3	1766.5	2803.8	2.7015	6.1437	240
250	39.73	1.2512	0.05013	1080.4	2602.4	1085.4	1716.2	2801.5	2.7927	6.0730	250
260	46.88	1.2755	0.04221	1128.4	2599.0	1134.4	1662.5	2796.6	2.8838	6.0019	260
270	54.99	1.3023	0.03564	1177.4	2593.7	1184.5	1605.2	2789.7	2.9751	5.9301	270
280	64.12	1.3321	0.03017	1227.5	2586.1	1236.0	1543.6	2779.6	3.0668	5.8571	280
290	74.36	1.3656	0.02557	1278.9	2576.0	1289.1	1477.1	2766.2	3.1594	5.7821	290
300	85.81	1.4036	0.02167	1332.0	2563.0	1344.0	1404.9	2749.0	3.2534	5.7045	300
320	112.7	1.4988	0.01549	1444.6	2525.5	1461.5	1238.6	2700.1	3.4480	5.5362	320
340	145.9	1.6379	0.01080	1570.3	2464.6	1594.2	1027.9	2622.0	3.6594	5.3357	340
360	186.5	1.8925	0.006945	1725.2	2351.5	1760.5	720.5	2481.0	3.9147	5.0526	360
374.14	220.9	3.155	0.003155	2029.6	2029.6	2099.3	0	2099.3	4.4298	4.4298	374.14

Source: Tables A-2 through A-5 are extracted from J. H. Keenan, F. G. Keyes, P. G. Hill, and J. G. Moore, *Steam Tables*, Wiley, New York, 1969.

TABLE A-3

Properties of Saturated Water (Liquid–Vapor): Pressure Table

Pressure Conversions:
1 bar = 0.1 MPa
= 10² kPa

Press. bar	Temp. °C	Specific Volume m ³ /kg		Internal Energy kJ/kg		Enthalpy kJ/kg			Entropy kJ/kg · K		Press. bar
		Sat. Liquid <i>v_f</i> × 10 ³	Sat. Vapor <i>v_g</i>	Sat. Liquid <i>u_f</i>	Sat. Vapor <i>u_g</i>	Sat. Liquid <i>h_f</i>	Evap. <i>h_{fg}</i>	Sat. Vapor <i>h_g</i>	Sat. Liquid <i>s_f</i>	Sat. Vapor <i>s_g</i>	
0.04	28.96	1.0040	34.800	121.45	2415.2	121.46	2432.9	2554.4	0.4226	8.4746	0.04
0.06	36.16	1.0064	23.739	151.53	2425.0	151.53	2415.9	2567.4	0.5210	8.3304	0.06
0.08	41.51	1.0084	18.103	173.87	2432.2	173.88	2403.1	2577.0	0.5926	8.2287	0.08
0.10	45.81	1.0102	14.674	191.82	2437.9	191.83	2392.8	2584.7	0.6493	8.1502	0.10
0.20	60.06	1.0172	7.649	251.38	2456.7	251.40	2358.3	2609.7	0.8320	7.9085	0.20
0.30	69.10	1.0223	5.229	289.20	2468.4	289.23	2336.1	2625.3	0.9439	7.7686	0.30
0.40	75.87	1.0265	3.993	317.53	2477.0	317.58	2319.2	2636.8	1.0259	7.6700	0.40
0.50	81.33	1.0300	3.240	340.44	2483.9	340.49	2305.4	2645.9	1.0910	7.5939	0.50
0.60	85.94	1.0331	2.732	359.79	2489.6	359.86	2293.6	2653.5	1.1453	7.5320	0.60
0.70	89.95	1.0360	2.365	376.63	2494.5	376.70	2283.3	2660.0	1.1919	7.4797	0.70
0.80	93.50	1.0380	2.087	391.58	2498.8	391.66	2274.1	2665.8	1.2329	7.4346	0.80
0.90	96.71	1.0410	1.869	405.06	2502.6	405.15	2265.7	2670.9	1.2695	7.3949	0.90
1.00	99.63	1.0432	1.694	417.36	2506.1	417.46	2258.0	2675.5	1.3026	7.3594	1.00
1.50	111.4	1.0528	1.159	466.94	2519.7	467.11	2226.5	2693.6	1.4336	7.2233	1.50
2.00	120.2	1.0605	0.8857	504.49	2529.5	504.70	2201.9	2706.7	1.5301	7.1271	2.00
2.50	127.4	1.0672	0.7187	535.10	2537.2	535.37	2181.5	2716.9	1.6072	7.0527	2.50
3.00	133.6	1.0732	0.6058	561.15	2543.6	561.47	2163.8	2725.3	1.6718	6.9919	3.00
3.50	138.9	1.0786	0.5243	583.95	2546.9	584.33	2148.1	2732.4	1.7275	6.9405	3.50
4.00	143.6	1.0836	0.4625	604.31	2553.6	604.74	2133.8	2738.6	1.7766	6.8959	4.00
4.50	147.9	1.0882	0.4140	622.25	2557.6	623.25	2120.7	2743.9	1.8207	6.8565	4.50
5.00	151.9	1.0926	0.3749	639.68	2561.2	640.23	2108.5	2748.7	1.8607	6.8212	5.00
6.00	158.9	1.1006	0.3157	669.90	2567.4	670.56	2086.3	2756.8	1.9312	6.7600	6.00
7.00	165.0	1.1080	0.2729	696.44	2572.5	697.22	2066.3	2763.5	1.9922	6.7080	7.00
8.00	170.4	1.1148	0.2404	720.22	2576.8	721.11	2048.0	2769.1	2.0462	6.6628	8.00
9.00	175.4	1.1212	0.2150	741.83	2580.5	742.83	2031.1	2773.9	2.0946	6.6226	9.00
10.0	179.9	1.1273	0.1944	761.68	2583.6	762.81	2015.3	2778.1	2.1387	6.5863	10.0
15.0	198.3	1.1539	0.1318	843.16	2594.5	844.84	1947.3	2792.2	2.3150	6.4448	15.0
20.0	212.4	1.1767	0.09963	906.44	2600.3	908.79	1890.7	2799.5	2.4474	6.3409	20.0
25.0	224.0	1.1973	0.07998	959.11	2603.1	962.11	1841.0	2803.1	2.5547	6.2575	25.0
30.0	233.9	1.2165	0.06668	1004.8	2604.1	1008.4	1795.7	2804.2	2.6457	6.1869	30.0
35.0	242.6	1.2347	0.05707	1045.4	2603.7	1049.8	1753.7	2803.4	2.7253	6.1253	35.0
40.0	250.4	1.2522	0.04978	1082.3	2602.3	1087.3	1714.1	2801.4	2.7964	6.0701	40.0
45.0	257.5	1.2692	0.04406	1116.2	2600.1	1121.9	1676.4	2798.3	2.8610	6.0199	45.0
50.0	264.0	1.2859	0.03944	1147.8	2597.1	1154.2	1640.1	2794.3	2.9202	5.9734	50.0
60.0	275.6	1.3187	0.03244	1205.4	2589.7	1213.4	1571.0	2784.3	3.0267	5.8892	60.0
70.0	285.9	1.3513	0.02737	1257.6	2580.5	1267.0	1505.1	2772.1	3.1211	5.8133	70.0
80.0	295.1	1.3842	0.02352	1305.6	2569.8	1316.6	1441.3	2758.0	3.2068	5.7432	80.0
90.0	303.4	1.4178	0.02048	1350.5	2557.8	1363.3	1378.9	2742.1	3.2858	5.6772	90.0
100.	311.1	1.4524	0.01803	1393.0	2544.4	1407.6	1317.1	2724.7	3.3596	5.6141	100.
110.	318.2	1.4886	0.01599	1433.7	2529.8	1450.1	1255.5	2705.6	3.4295	5.5527	110.

H₂O

TABLE A-3

(Continued)

Press. bar	Temp. °C	Specific Volume m ³ /kg		Internal Energy kJ/kg		Enthalpy kJ/kg			Entropy kJ/kg · K		Press. bar
		Sat. Liquid $v_f \times 10^3$	Sat. Vapor v_g	Sat. Liquid u_f	Sat. Vapor u_g	Sat. Liquid h_f	Evap. h_{fg}	Sat. Vapor h_g	Sat. Liquid s_f	Sat. Vapor s_g	
120.	324.8	1.5267	0.01426	1473.0	2513.7	1491.3	1193.6	2684.9	3.4962	5.4924	120.
130.	330.9	1.5671	0.01278	1511.1	2496.1	1531.5	1130.7	2662.2	3.5606	5.4323	130.
140.	336.8	1.6107	0.01149	1548.6	2476.8	1571.1	1066.5	2637.6	3.6232	5.3717	140.
150.	342.2	1.6581	0.01034	1585.6	2455.5	1610.5	1000.0	2610.5	3.6848	5.3098	150.
160.	347.4	1.7107	0.009306	1622.7	2431.7	1650.1	930.6	2580.6	3.7461	5.2455	160.
170.	352.4	1.7702	0.008364	1660.2	2405.0	1690.3	856.9	2547.2	3.8079	5.1777	170.
180.	357.1	1.8397	0.007489	1698.9	2374.3	1732.0	777.1	2509.1	3.8715	5.1044	180.
190.	361.5	1.9243	0.006657	1739.9	2338.1	1776.5	688.0	2464.5	3.9388	5.0228	190.
200.	365.8	2.036	0.005834	1785.6	2293.0	1826.3	583.4	2409.7	4.0139	4.9269	200.
220.9	374.1	3.155	0.003155	2029.6	2029.6	2099.3	0	2099.3	4.4298	4.4298	220.9

TABLE A-4

Properties of Superheated Water Vapor

<i>T</i> °C	<i>v</i> m ³ /kg	<i>u</i> kJ/kg	<i>h</i> kJ/kg	<i>s</i> kJ/kg · K	<i>v</i> m ³ /kg	<i>u</i> kJ/kg	<i>h</i> kJ/kg	<i>s</i> kJ/kg · K
<i>p</i> = 0.06 bar = 0.006 MPa (<i>T</i>_{sat} = 36.16°C)				<i>p</i> = 0.35 bar = 0.035 MPa (<i>T</i>_{sat} = 72.69°C)				
Sat.	23.739	2425.0	2567.4	8.3304	4.526	2473.0	2631.4	7.7158
80	27.132	2487.3	2650.1	8.5804	4.625	2483.7	2645.6	7.7564
120	30.219	2544.7	2726.0	8.7840	5.163	2542.4	2723.1	7.9644
160	33.302	2602.7	2802.5	8.9693	5.696	2601.2	2800.6	8.1519
200	36.383	2661.4	2879.7	9.1398	6.228	2660.4	2878.4	8.3237
240	39.462	2721.0	2957.8	9.2982	6.758	2720.3	2956.8	8.4828
280	42.540	2781.5	3036.8	9.4464	7.287	2780.9	3036.0	8.6314
320	45.618	2843.0	3116.7	9.5859	7.815	2842.5	3116.1	8.7712
360	48.696	2905.5	3197.7	9.7180	8.344	2905.1	3197.1	8.9034
400	51.774	2969.0	3279.6	9.8435	8.872	2968.6	3279.2	9.0291
440	54.851	3033.5	3362.6	9.9633	9.400	3033.2	3362.2	9.1490
500	59.467	3132.3	3489.1	10.1336	10.192	3132.1	3488.8	9.3194
<i>p</i> = 0.70 bar = 0.07 MPa (<i>T</i>_{sat} = 89.95°C)				<i>p</i> = 1.0 bar = 0.10 MPa (<i>T</i>_{sat} = 99.63°C)				
Sat.	2.365	2494.5	2660.0	7.4797	1.694	2506.1	2675.5	7.3594
100	2.434	2509.7	2680.0	7.5341	1.696	2506.7	2676.2	7.3614
120	2.571	2539.7	2719.6	7.6375	1.793	2537.3	2716.6	7.4668
160	2.841	2599.4	2798.2	7.8279	1.984	2597.8	2796.2	7.6597
200	3.108	2659.1	2876.7	8.0012	2.172	2658.1	2875.3	7.8343
240	3.374	2719.3	2955.5	8.1611	2.359	2718.5	2954.5	7.9949
280	3.640	2780.2	3035.0	8.3162	2.546	2779.6	3034.2	8.1445
320	3.905	2842.0	3115.3	8.4504	2.732	2841.5	3114.6	8.2849
360	4.170	2904.6	3196.5	8.5828	2.917	2904.2	3195.9	8.4175
400	4.434	2968.2	3278.6	8.7086	3.103	2967.9	3278.2	8.5435
440	4.698	3032.9	3361.8	8.8286	3.288	3032.6	3361.4	8.6636
500	5.095	3131.8	3488.5	8.9991	3.565	3131.6	3488.1	8.8342
<i>p</i> = 1.5 bar = 0.15 MPa (<i>T</i>_{sat} = 111.37°C)				<i>p</i> = 3.0 bar = 0.30 MPa (<i>T</i>_{sat} = 133.55°C)				
Sat.	1.159	2519.7	2693.6	7.2233	0.606	2543.6	2725.3	6.9919
120	1.188	2533.3	2711.4	7.2693				
160	1.317	2595.2	2792.8	7.4665	0.651	2587.1	2782.3	7.1276
200	1.444	2656.2	2872.9	7.6433	0.716	2650.7	2865.5	7.3115
240	1.570	2717.2	2952.7	7.8052	0.781	2713.1	2947.3	7.4774
280	1.695	2778.6	3032.8	7.9555	0.844	2775.4	3028.6	7.6299
320	1.819	2840.6	3113.5	8.0964	0.907	2838.1	3110.1	7.7722
360	1.943	2903.5	3195.0	8.2293	0.969	2901.4	3192.2	7.9061
400	2.067	2967.3	3277.4	8.3555	1.032	2965.6	3275.0	8.0330
440	2.191	3032.1	3360.7	8.4757	1.094	3030.6	3358.7	8.1538
500	2.376	3131.2	3487.6	8.6466	1.187	3130.0	3486.0	8.3251
600	2.685	3301.7	3704.3	8.9101	1.341	3300.8	3703.2	8.5892

Pressure Conversions:
1 bar = 0.1 MPa
= 10² kPa

TABLE A-4

(Continued)

<i>T</i> °C	<i>v</i> m ³ /kg	<i>u</i> kJ/kg	<i>h</i> kJ/kg	<i>s</i> kJ/kg · K	<i>v</i> m ³ /kg	<i>u</i> kJ/kg	<i>h</i> kJ/kg	<i>s</i> kJ/kg · K
<i>p</i> = 5.0 bar = 0.50 MPa (<i>T</i>_{sat} = 151.86°C)				<i>p</i> = 7.0 bar = 0.70 MPa (<i>T</i>_{sat} = 164.97°C)				
Sat.	0.3749	2561.2	2748.7	6.8213	0.2729	2572.5	2763.5	6.7080
180	0.4045	2609.7	2812.0	6.9656	0.2847	2599.8	2799.1	6.7880
200	0.4249	2642.9	2855.4	7.0592	0.2999	2634.8	2844.8	6.8865
240	0.4646	2707.6	2939.9	7.2307	0.3292	2701.8	2932.2	7.0641
280	0.5034	2771.2	3022.9	7.3865	0.3574	2766.9	3017.1	7.2233
320	0.5416	2834.7	3105.6	7.5308	0.3852	2831.3	3100.9	7.3697
360	0.5796	2898.7	3188.4	7.6660	0.4126	2895.8	3184.7	7.5063
400	0.6173	2963.2	3271.9	7.7938	0.4397	2960.9	3268.7	7.6350
440	0.6548	3028.6	3356.0	7.9152	0.4667	3026.6	3353.3	7.7571
500	0.7109	3128.4	3483.9	8.0873	0.5070	3126.8	3481.7	7.9299
600	0.8041	3299.6	3701.7	8.3522	0.5738	3298.5	3700.2	8.1956
700	0.8969	3477.5	3925.9	8.5952	0.6403	3476.6	3924.8	8.4391
<i>p</i> = 10.0 bar = 1.0 MPa (<i>T</i>_{sat} = 179.91°C)				<i>p</i> = 15.0 bar = 1.5 MPa (<i>T</i>_{sat} = 198.32°C)				
Sat.	0.1944	2583.6	2778.1	6.5865	0.1318	2594.5	2792.2	6.4448
200	0.2060	2621.9	2827.9	6.6940	0.1325	2598.1	2796.8	6.4546
240	0.2275	2692.9	2920.4	6.8817	0.1483	2676.9	2899.3	6.6628
280	0.2480	2760.2	3008.2	7.0465	0.1627	2748.6	2992.7	6.8381
320	0.2678	2826.1	3093.9	7.1962	0.1765	2817.1	3081.9	6.9938
360	0.2873	2891.6	3178.9	7.3349	0.1899	2884.4	3169.2	7.1363
400	0.3066	2957.3	3263.9	7.4651	0.2030	2951.3	3255.8	7.2690
440	0.3257	3023.6	3349.3	7.5883	0.2160	3018.5	3342.5	7.3940
500	0.3541	3124.4	3478.5	7.7622	0.2352	3120.3	3473.1	7.5698
540	0.3729	3192.6	3565.6	7.8720	0.2478	3189.1	3560.9	7.6805
600	0.4011	3296.8	3697.9	8.0290	0.2668	3293.9	3694.0	7.8385
640	0.4198	3367.4	3787.2	8.1290	0.2793	3364.8	3783.8	7.9391
<i>p</i> = 20.0 bar = 2.0 MPa (<i>T</i>_{sat} = 212.42°C)				<i>p</i> = 30.0 bar = 3.0 MPa (<i>T</i>_{sat} = 233.90°C)				
Sat.	0.0996	2600.3	2799.5	6.3409	0.0667	2604.1	2804.2	6.1869
240	0.1085	2659.6	2876.5	6.4952	0.0682	2619.7	2824.3	6.2265
280	0.1200	2736.4	2976.4	6.6828	0.0771	2709.9	2941.3	6.4462
320	0.1308	2807.9	3069.5	6.8452	0.0850	2788.4	3043.4	6.6245
360	0.1411	2877.0	3159.3	6.9917	0.0923	2861.7	3138.7	6.7801
400	0.1512	2945.2	3247.6	7.1271	0.0994	2932.8	3230.9	6.9212
440	0.1611	3013.4	3335.5	7.2540	0.1062	3002.9	3321.5	7.0520
500	0.1757	3116.2	3467.6	7.4317	0.1162	3108.0	3456.5	7.2338
540	0.1853	3185.6	3556.1	7.5434	0.1227	3178.4	3546.6	7.3474
600	0.1996	3290.9	3690.1	7.7024	0.1324	3285.0	3682.3	7.5085
640	0.2091	3362.2	3780.4	7.8035	0.1388	3357.0	3773.5	7.6106
700	0.2232	3470.9	3917.4	7.9487	0.1484	3466.5	3911.7	7.7571

TABLE A-4

(Continued)

<i>T</i> °C	<i>v</i> m ³ /kg	<i>u</i> kJ/kg	<i>h</i> kJ/kg	<i>s</i> kJ/kg · K	<i>v</i> m ³ /kg	<i>u</i> kJ/kg	<i>h</i> kJ/kg	<i>s</i> kJ/kg · K
<i>p</i> = 40 bar = 4.0 MPa (<i>T</i>_{sat} = 250.4°C)								
Sat.	0.04978	2602.3	2801.4	6.0701	0.03244	2589.7	2784.3	5.8892
280	0.05546	2680.0	2901.8	6.2568	0.03317	2605.2	2804.2	5.9252
320	0.06199	2767.4	3015.4	6.4553	0.03876	2720.0	2952.6	6.1846
360	0.06788	2845.7	3117.2	6.6215	0.04331	2811.2	3071.1	6.3782
400	0.07341	2919.9	3213.6	6.7690	0.04739	2892.9	3177.2	6.5408
440	0.07872	2992.2	3307.1	6.9041	0.05122	2970.0	3277.3	6.6853
500	0.08643	3099.5	3445.3	7.0901	0.05665	3082.2	3422.2	6.8803
540	0.09145	3171.1	3536.9	7.2056	0.06015	3156.1	3517.0	6.9999
600	0.09885	3279.1	3674.4	7.3688	0.06525	3266.9	3658.4	7.1677
640	0.1037	3351.8	3766.6	7.4720	0.06859	3341.0	3752.6	7.2731
700	0.1110	3462.1	3905.9	7.6198	0.07352	3453.1	3894.1	7.4234
740	0.1157	3536.6	3999.6	7.7141	0.07677	3528.3	3989.2	7.5190
<i>p</i> = 60 bar = 6.0 MPa (<i>T</i>_{sat} = 275.64°C)								
<i>p</i> = 80 bar = 8.0 MPa (<i>T</i>_{sat} = 295.06°C)								
Sat.	0.02352	2569.8	2758.0	5.7432	0.01803	2544.4	2724.7	5.6141
320	0.02682	2662.7	2877.2	5.9489	0.01925	2588.8	2781.3	5.7103
360	0.03089	2772.7	3019.8	6.1819	0.02331	2729.1	2962.1	6.0060
400	0.03432	2863.8	3138.3	6.3634	0.02641	2832.4	3096.5	6.2120
440	0.03742	2946.7	3246.1	6.5190	0.02911	2922.1	3213.2	6.3805
480	0.04034	3025.7	3348.4	6.6586	0.03160	3005.4	3321.4	6.5282
520	0.04313	3102.7	3447.7	6.7871	0.03394	3085.6	3425.1	6.6622
560	0.04582	3178.7	3545.3	6.9072	0.03619	3164.1	3526.0	6.7864
600	0.04845	3254.4	3642.0	7.0206	0.03837	3241.7	3625.3	6.9029
640	0.05102	3330.1	3738.3	7.1283	0.04048	3318.9	3723.7	7.0131
700	0.05481	3443.9	3882.4	7.2812	0.04358	3434.7	3870.5	7.1687
740	0.05729	3520.4	3978.7	7.3782	0.04560	3512.1	3968.1	7.2670
<i>p</i> = 100 bar = 10.0 MPa (<i>T</i>_{sat} = 311.06°C)								
<i>p</i> = 120 bar = 12.0 MPa (<i>T</i>_{sat} = 324.75°C)								
Sat.	0.01426	2513.7	2684.9	5.4924	0.01149	2476.8	2637.6	5.3717
360	0.01811	2678.4	2895.7	5.8361	0.01422	2617.4	2816.5	5.6602
400	0.02108	2798.3	3051.3	6.0747	0.01722	2760.9	3001.9	5.9448
440	0.02355	2896.1	3178.7	6.2586	0.01954	2868.6	3142.2	6.1474
480	0.02576	2984.4	3293.5	6.4154	0.02157	2962.5	3264.5	6.3143
520	0.02781	3068.0	3401.8	6.5555	0.02343	3049.8	3377.8	6.4610
560	0.02977	3149.0	3506.2	6.6840	0.02517	3133.6	3486.0	6.5941
600	0.03164	3228.7	3608.3	6.8037	0.02683	3215.4	3591.1	6.7172
640	0.03345	3307.5	3709.0	6.9164	0.02843	3296.0	3694.1	6.8326
700	0.03610	3425.2	3858.4	7.0749	0.03075	3415.7	3846.2	6.9939
740	0.03781	3503.7	3957.4	7.1746	0.03225	3495.2	3946.7	7.0952
<i>p</i> = 140 bar = 14.0 MPa (<i>T</i>_{sat} = 336.75°C)								

TABLE A-4

(Continued)

<i>T</i> °C	<i>v</i> m ³ /kg	<i>u</i> kJ/kg	<i>h</i> kJ/kg	<i>s</i> kJ/kg · K	<i>v</i> m ³ /kg	<i>u</i> kJ/kg	<i>h</i> kJ/kg	<i>s</i> kJ/kg · K
<i>p</i> = 160 bar = 16.0 MPa (<i>T</i>_{sat} = 347.44°C)					<i>p</i> = 180 bar = 18.0 MPa (<i>T</i>_{sat} = 357.06°C)			
Sat.	0.00931	2431.7	2580.6	5.2455	0.00749	2374.3	2509.1	5.1044
360	0.01105	2539.0	2715.8	5.4614	0.00809	2418.9	2564.5	5.1922
400	0.01426	2719.4	2947.6	5.8175	0.01190	2672.8	2887.0	5.6887
440	0.01652	2839.4	3103.7	6.0429	0.01414	2808.2	3062.8	5.9428
480	0.01842	2939.7	3234.4	6.2215	0.01596	2915.9	3203.2	6.1345
520	0.02013	3031.1	3353.3	6.3752	0.01757	3011.8	3378.0	6.2960
560	0.02172	3117.8	3465.4	6.5132	0.01904	3101.7	3444.4	6.4392
600	0.02323	3201.8	3573.5	6.6399	0.02042	3188.0	3555.6	6.5696
640	0.02467	3284.2	3678.9	6.7580	0.02174	3272.3	3663.6	6.6905
700	0.02674	3406.0	3833.9	6.9224	0.02362	3396.3	3821.5	6.8580
740	0.02808	3486.7	3935.9	7.0251	0.02483	3478.0	3925.0	6.9623
<i>p</i> = 200 bar = 20.0 MPa (<i>T</i>_{sat} = 365.81°C)					<i>p</i> = 240 bar = 24.0 MPa			
Sat.	0.00583	2293.0	2409.7	4.9269	0.00673	2477.8	2639.4	5.2393
400	0.00994	2619.3	2818.1	5.5540	0.00929	2700.6	2923.4	5.6506
440	0.01222	2774.9	3019.4	5.8450	0.01100	2838.3	3102.3	5.8950
480	0.01399	2891.2	3170.8	6.0518	0.01241	2950.5	3248.5	6.0842
520	0.01551	2992.0	3302.2	6.2218	0.01366	3051.1	3379.0	6.2448
560	0.01689	3085.2	3423.0	6.3705	0.01481	3145.2	3500.7	6.3875
600	0.01818	3174.0	3537.6	6.5048	0.01588	3235.5	3616.7	6.5174
640	0.01940	3260.2	3648.1	6.6286	0.01739	3366.4	3783.8	6.6947
700	0.02113	3386.4	3809.0	6.7993	0.01835	3451.7	3892.1	6.8038
740	0.02224	3469.3	3914.1	6.9052	0.01974	3578.0	4051.6	6.9567
800	0.02385	3592.7	4069.7	7.0544				
<i>p</i> = 280 bar = 28.0 MPa					<i>p</i> = 320 bar = 32.0 MPa			
400	0.00383	2223.5	2330.7	4.7494	0.00236	1980.4	2055.9	4.3239
440	0.00712	2613.2	2812.6	5.4494	0.00544	2509.0	2683.0	5.2327
480	0.00885	2780.8	3028.5	5.7446	0.00722	2718.1	2949.2	5.5968
520	0.01020	2906.8	3192.3	5.9566	0.00853	2860.7	3133.7	5.8357
560	0.01136	3015.7	3333.7	6.1307	0.00963	2979.0	3287.2	6.0246
600	0.01241	3115.6	3463.0	6.2823	0.01061	3085.3	3424.6	6.1858
640	0.01338	3210.3	3584.8	6.4187	0.01150	3184.5	3552.5	6.3290
700	0.01473	3346.1	3758.4	6.6029	0.01273	3325.4	3732.8	6.5203
740	0.01558	3433.9	3870.0	6.7153	0.01350	3415.9	3847.8	6.6361
800	0.01680	3563.1	4033.4	6.8720	0.01460	3548.0	4015.1	6.7966
900	0.01873	3774.3	4298.8	7.1084	0.01633	3762.7	4285.1	7.0372

TABLE A-5

Properties of Compressed Liquid Water

<i>T</i> °C	<i>v</i> × 10 ³ m ³ /kg	<i>u</i> kJ/kg	<i>h</i> kJ/kg	<i>s</i> kJ/kg · K	<i>v</i> × 10 ³ m ³ /kg	<i>u</i> kJ/kg	<i>h</i> kJ/kg	<i>s</i> kJ/kg · K	
<i>p</i> = 25 bar = 2.5 MPa (<i>T</i>_{sat} = 223.99°C)					<i>p</i> = 50 bar = 5.0 MPa (<i>T</i>_{sat} = 263.99°C)				
20	1.0006	83.80	86.30	.2961	.9995	83.65	88.65	.2956	
40	1.0067	167.25	169.77	.5715	1.0056	166.95	171.97	.5705	
80	1.0280	334.29	336.86	1.0737	1.0268	333.72	338.85	1.0720	
100	1.0423	418.24	420.85	1.3050	1.0410	417.52	422.72	1.3030	
140	1.0784	587.82	590.52	1.7369	1.0768	586.76	592.15	1.7343	
180	1.1261	761.16	763.97	2.1375	1.1240	759.63	765.25	2.1341	
200	1.1555	849.9	852.8	2.3294	1.1530	848.1	853.9	2.3255	
220	1.1898	940.7	943.7	2.5174	1.1866	938.4	944.4	2.5128	
Sat.	1.1973	959.1	962.1	2.5546	1.2859	1147.8	1154.2	2.9202	
<i>p</i> = 75 bar = 7.5 MPa (<i>T</i>_{sat} = 290.59°C)					<i>p</i> = 100 bar = 10.0 MPa (<i>T</i>_{sat} = 311.06°C)				
20	.9984	83.50	90.99	.2950	.9972	83.36	93.33	.2945	
40	1.0045	166.64	174.18	.5696	1.0034	166.35	176.38	.5686	
80	1.0256	333.15	340.84	1.0704	1.0245	332.59	342.83	1.0688	
100	1.0397	416.81	424.62	1.3011	1.0385	416.12	426.50	1.2992	
140	1.0752	585.72	593.78	1.7317	1.0737	584.68	595.42	1.7292	
180	1.1219	758.13	766.55	2.1308	1.1199	756.65	767.84	2.1275	
220	1.1835	936.2	945.1	2.5083	1.1805	934.1	945.9	2.5039	
260	1.2696	1124.4	1134.0	2.8763	1.2645	1121.1	1133.7	2.8699	
Sat.	1.3677	1282.0	1292.2	3.1649	1.4524	1393.0	1407.6	3.3596	
<i>p</i> = 150 bar = 15.0 MPa (<i>T</i>_{sat} = 342.24°C)					<i>p</i> = 200 bar = 20.0 MPa (<i>T</i>_{sat} = 365.81°C)				
20	.9950	83.06	97.99	.2934	.9928	82.77	102.62	.2923	
40	1.0013	165.76	180.78	.5666	.9992	165.17	185.16	.5646	
80	1.0222	331.48	346.81	1.0656	1.0199	330.40	350.80	1.0624	
100	1.0361	414.74	430.28	1.2955	1.0337	413.39	434.06	1.2917	
140	1.0707	582.66	598.72	1.7242	1.0678	580.69	602.04	1.7193	
180	1.1159	753.76	770.50	2.1210	1.1120	750.95	773.20	2.1147	
220	1.1748	929.9	947.5	2.4953	1.1693	925.9	949.3	2.4870	
260	1.2550	1114.6	1133.4	2.8576	1.2462	1108.6	1133.5	2.8459	
300	1.3770	1316.6	1337.3	3.2260	1.3596	1306.1	1333.3	3.2071	
Sat.	1.6581	1585.6	1610.5	3.6848	2.036	1785.6	1826.3	4.0139	
<i>p</i> = 250 bar = 25 MPa					<i>p</i> = 300 bar = 30.0 MPa				
20	.9907	82.47	107.24	.2911	.9886	82.17	111.84	.2899	
40	.9971	164.60	189.52	.5626	.9951	164.04	193.89	.5607	
100	1.0313	412.08	437.85	1.2881	1.0290	410.78	441.66	1.2844	
200	1.1344	834.5	862.8	2.2961	1.1302	831.4	865.3	2.2893	
300	1.3442	1296.6	1330.2	3.1900	1.3304	1287.9	1327.8	3.1741	

Pressure Conversions:
1 bar = 0.1 MPa
= 10² kPa