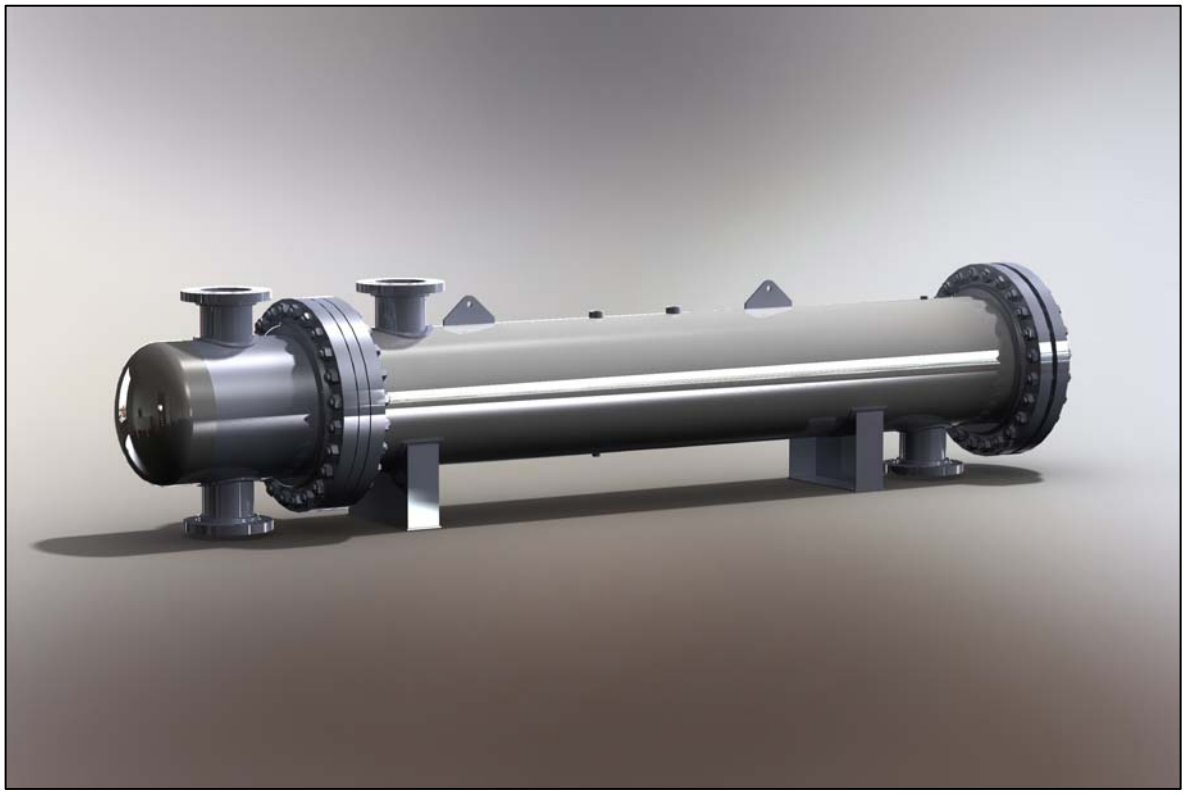
SHELL & TUBE HEAT EXCHANGERS

INSTALLATION, OPERATION & MAINTENANCE MANUAL



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1 FOREWORD

This manual is a guide for installation, commissioning and maintenance of shell & tube heat exchangers supplied by Alstrom Heat Transfer LLC.

It is meant for those who are responsible for the installation, the use and maintenance of the heat exchangers. We recommend that you read this manual carefully before commencing any work.

2 INTRODUCTION

This manual is applicable for all heat exchangers produced and supplied by Alstrom Heat Transfer LLC.

Alstrom Heat Transfer LLC cannot be held responsible or liable for damage as a result of incorrect installation, use and/or maintenance of Alstrom shell & tube heat exchanger as well as not complying with the instructions in this manual.

Please note that our shell & tube type heat exchangers are specially designed and built for the operating conditions (pressures, temperatures, capacities and type of fluids) provided by the customer. Sudden pressure peaks beyond the normal operating pressure (or pressure surges) which can occur during starting up or stopping of the system can severely damage the heat exchanger and should be prevented. Alstrom cannot be held responsible for any damage as a result of any operation deviating from the original design conditions.

You may only commission the heat exchanger under the modified conditions after inspection and written approval by Alstrom Heat Transfer LLC. Also the name plate on the heat exchanger will be adapted.

3 SAFETY ALERT NOTICES

Refer to applicable SAFETY ALERT notices within the manual

All SAFETY ALERT notices are applicable to personal injury and identified by the following symbol.

CONTENTS

4 GENERAL

4.1 Identification of the heat exchanger

All heat exchangers supplied by Alstrom are provided with a name plate. On this plate the following details are specified:

- Heat Exchanger Model
- Manufacturing Serial Number
- Max. working pressure in PSIG
- Test pressure in PSIG
- Max. working temperature in °F

4.2 Correct operation

This user manual provides information and instructions for correct and safe operation of the unit. Many accidents are caused by incorrect use!
It is essential that you study the instructions carefully, and above all, ensure the availability to those who install, maintain and operate the apparatus on a daily basis. This manual will be of no value if it is not available at the time when your staff needs it.

Should you have a problem with your Alstrom Heat Exchanger which is beyond the scope of this manual, do not hesitate to contact us. The installation should not be put into operation before all indistinctness's have been solved!

To avoid injuries and damages, follow the instructions and local applicable safety regulations. Also take the necessary protective measures, depending on the nature of your process or circumstances related to it, at your plant.

Please note that our heat exchangers are especially designed and built for the operating conditions (pressures, temperatures, capacities and type of fluids) provided by the customer. Sudden pressure peaks beyond the normal operating pressure (or pressure surges) which can occur during starting up or stopping of the system can severely damage the heat exchanger and should be prevented. Alstrom cannot be held responsible for any damage as a result of any operation deviating from the original design conditions.

If you wish to alter the design conditions, please contact us. You may only commission the heat exchanger under the modified conditions after inspection and written approval by Alstrom. Also the name plate on the heat exchanger will be adapted.

4.3 Precautions

All potential personal injury hazards are identified by safety alert symbol.

Bodily harm can be caused by:

- Burning as a result of touching the heat exchanger or other parts of the installation.

- The uncontrolled release of pressurized media with which the danger of burning and other injuries is present.
- Contact with chemicals.
- Touching sharp edges of the installation.

Damage to equipment can be caused by:

- External forces.
- Corrosion.
- Chemical action.
- Erosion.
- Weary.
- Water hammer;
- Thermal and / or mechanical shock.
- Freezing.
- Wrong transport / lifting.

Even after stopping the installation some parts of it can still be hot!

The heat exchanger may only be used with the fluids specified on the datasheet.

The hot medium may not flow through the heat exchanger without the cold medium flowing through. This is to prevent damage to the apparatus.

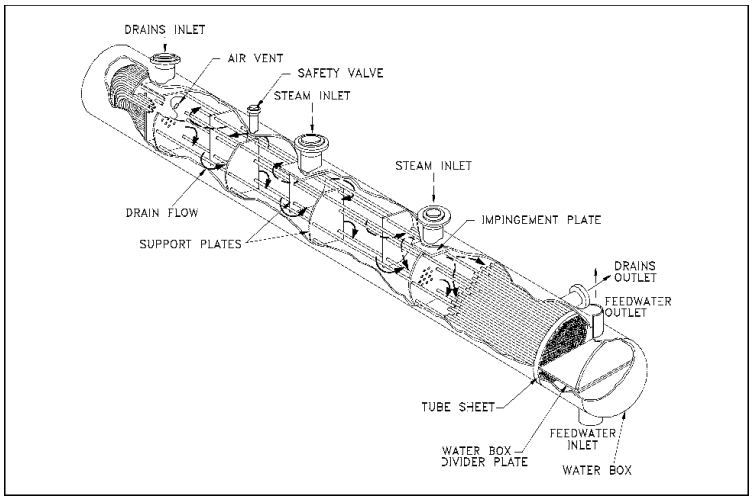
In case the cold medium is present but does not flow while the hot medium is flowing through, the cold medium will start boiling and the heat exchanger will be damaged.

Sudden pressure and temperature changes should be prevented.

5 CONSTRUCTION

5.1 Basics

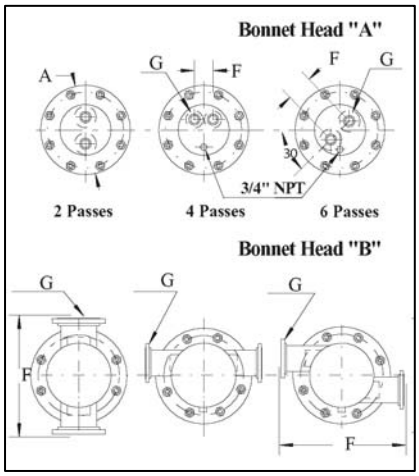
The tube and shell heat exchanger consists of a set of tubes in a container called a shell. The fluid flowing inside the tubes is called the tube side fluid and the fluid flowing on the outside of the tubes is the shell side fluid. At the ends of the tubes, the tube side fluid is separated from the shell side fluid by the tube sheet(s). The tubes are rolled and press-fitted or welded into the tube sheet to provide a leak tight seal. In systems where the two fluids are at vastly different pressures, the higher pressure fluid is typically directed through the tubes and the lower pressure fluid is circulated on the shell side. The support plates shown also act as baffles to direct the flow of fluid within the shell back and forth across the tubes.



5.2 Single or multi pass heat exchangers

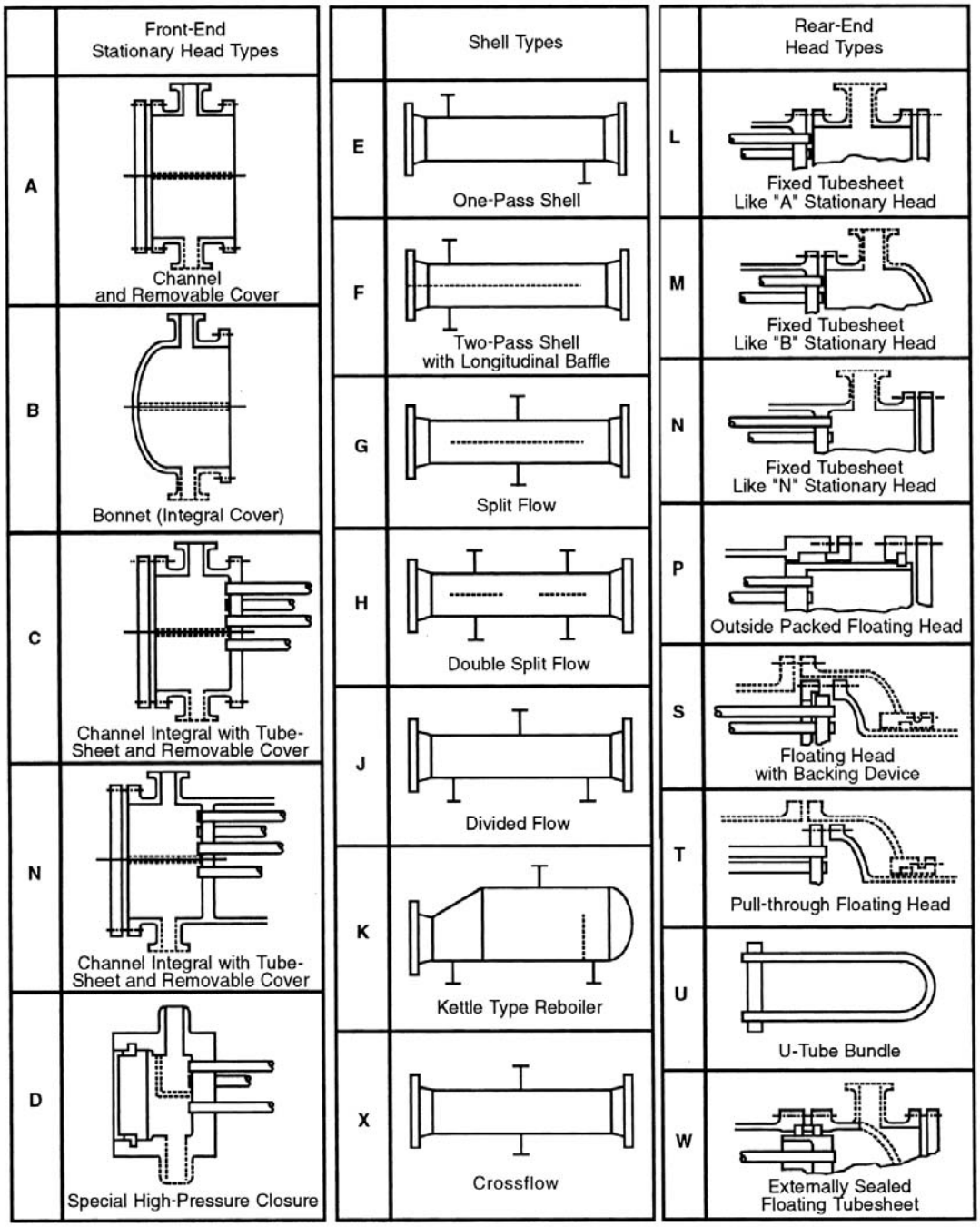
Single Pass: A media (fluid) is considered to have made one pass if it flows through a section of the heat exchanger through its length once.

Multi Pass: A media (fluid) is reversed and flows through the flow length two or more times.



5.3 TEMA Classification

Shell-and-tube exchangers are classified and constructed in accordance with the widely used TEMA (Tubular Exchanger Manufacturers Association) standards (TEMA). TEMA has developed a notation system to designate major types of shell & tube exchangers. In this system, each exchanger is designated by a three-letter combination, the first letter indicating the front-end head type, the second the shell type, and the third the rear-end head type. These are identified of some common shell & tube exchangers are AES, BEM, AEP, CFU, AKT, and AJW.



6 INSTALLATION

6.1 Requirements to the Installation Area

It is very important that enough space around the heat exchanger is kept free for servicing of the unit:

U-Tube heat exchangers:	provide sufficient clearance at the stationary head end for withdrawal of the tube bundle, or at the opposite end to permit the removal of the shell.
Straight Tube heat exchangers (removable bundles):	allow for sufficient clearance at the stationary head end for removal of the bundle from the shell and provide adequate space beyond the rear head to accommodate removal of the shell cover and/or floating head cover.
Fixed Tubesheet heat exchangers:	provide sufficient clearance at one end for withdrawal and replacement of the tubes and enough space beyond the head at the opposite end to permit removal of the bonnet or channel cover.

Foundations must be adequate so that exchangers will not settle and cause piping strains. Foundation bolts should be set to allow for setting inaccuracies. In concrete footings, pipe sleeves at least one size larger than the bolt diameter slipped over the bolt and cast in place are best for this purpose, as they allow the bolt center to be adjusted after the foundation has set.

6.2 Standard Installation Requirements

Provide valves and by-passes in the piping system so that both the shell and tube bundle may be by-passed to permit cutting out the unit for inspection or repairs.

Safety Device Connections are provided when required on shells. To safeguard against failures or possible ruptures during operation, the unit must be protected with a safety relief valve set at the proper pressure. In the tube circuit, such devices should be placed in the inlet piping between the nearest valve and the unit.

Provide convenient means for frequent cleaning of the unit as suggested under "Maintenance."

Provide thermometer wells and pressure gage connections in all piping to and from the unit, as near the unit as possible.

Provide necessary air vent cocks so that the unit can be purged to prevent or relieve vapor or gas binding of either the tube bundle or the shell.

Loosen foundation bolts at one end of the unit to allow free expansion of shell. Oval holes in foundation brackets are provided for this purpose (if applicable).

Inspect all openings in the heat exchanger for foreign material. Remove all wooden plugs and shipping pads just before installing.

Set exchangers level and square so that pipe connections may be made without forcing.

Be sure entire system is clean before starting operation to prevent plugging of tubes or shell side passages with sand or refuse. The use of strainers or settling tanks in pipelines leading to the heat exchanger is recommended.

Provide thermometer wells and pressure gauge pipe taps in all piping to and from the heat exchanger, as close as possible to the unit for heat exchanger performance evaluation.

To guard against pulsation of the fluids caused by reciprocating pumps, compressors or other equipment a surge drum should be installed.

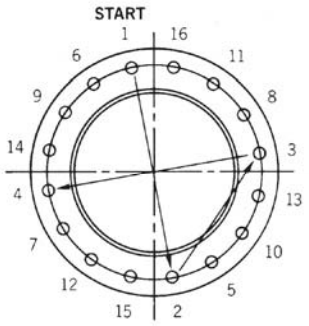
6.3 Recommended Bolt Tightening Procedure

Heat exchangers are pressure tested before leaving the manufacture's shop in accordance with ASME Code requirements. However, normal relaxing of the gasketed joints may occur in the interval between testing in the manufacturer's shop and installation at the jobsite. Therefore, all external bolted joints may require retightening after installation and, if necessary, after the exchanger has reached operating temperature. It is important that all bolted joints be tightened uniformly and in a diametrically staggered pattern as illustrated in bellow, except for special high pressure closures when the instructions of the manufacturer should be followed.

Torque Values for Compressed Fiber Gaskets*

SIZE	TORQUE (FT. LBS.)	TORQUE STEPS
1/4-20	8	1
5/16-18	16	1
3/8-16	24	2
1/2-13	60	2
5/8-11	120	2
3/4-10	215	3
1-8	515	3
1 1/8-8	760	3
1 1/4-8	1060	3
1 1/2-8	1900	3
1 3/4-8	3105	4
2-8	4725	4

*Contact factory for other types of gaskets. (See drawings or parts list for gasket information.) Torque valves are for lubricated threads.



BOLT TIGHTENING PROCEDURE

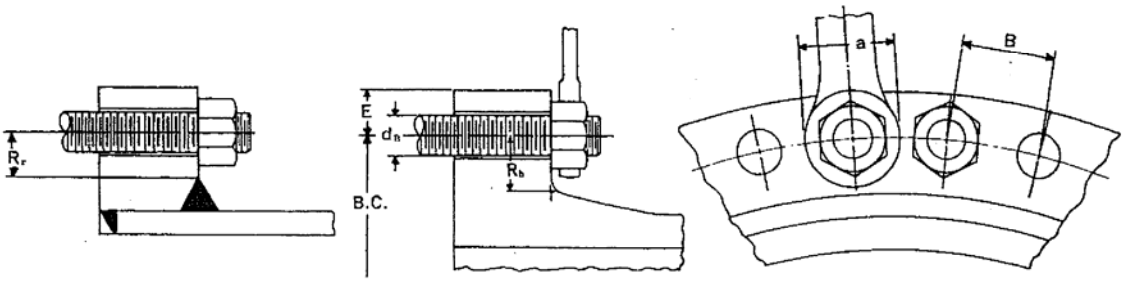
GENERAL INFORMATION

TABLE D-5

BOLTING DATA - RECOMMENDED MINIMUM

(All Dimensions in Inches Unless Noted)

Bolt Size d_n	Threads		Nut Dimensions		Bolt Spacing B	Radial Distance R_h	Radial Distance R_r	Edge Distance E	Wrench Diameter a	Bolt Size d_n
	No. of Threads	Root Area In.²	Across Flats	Across Corners						
½	13	0.126	⅞	0.969	1¼	13/16	⅝	⅝	1½	½
⅝	11	0.202	1 1/16	1.175	1½	13/16	¾	¾	1¾	⅝
¾	10	0.302	1¼	1.383	1¾	1⅛	13/16	13/16	2 1/16	¾
⅞	9	0.419	1 7/16	1.589	2 1/16	1¼	15/16	15/16	2⅜	⅞
1	8	0.551	1⅝	1.796	2¼	1⅜	1 1/16	1 1/16	2⅝	1
1⅛	8	0.728	1 13/16	2.002	2½	1½	1⅛	1⅛	2⅞	1⅛
1¼	8	0.929	2	2.209	2 13/16	1¾	1¼	1¼	3¼	1¼
1⅜	8	1.155	2 3/16	2.416	3 1/16	1⅞	1⅜	1⅜	3½	1⅜
1½	8	1.405	2⅜	2.622	3¼	2	1½	1½	3¾	1½
1⅝	8	1.680	2 9/16	2.828	3½	2⅛		1⅝	4	1⅝
1¾	8	1.980	2¾	3.035	3¾	2¼		1¾	4¼	1¼
1⅞	8	2.304	2 15/16	3.242	4	2⅜		1⅞	4½	1⅞
2	8	2.652	3⅛	3.449	4¼	2½		2	4¾	2
2¼	8	3.423	3½	3.862	4¾	2¾		2¼	5¼	2¼
2½	8	4.292	3⅞	4.275	5¼	3 1/16		2⅜	5⅞	2½
2¾	8	5.259	4¼	4.688	5¾	3⅓		2⅝	6½	2¾
3	8	6.324	4⅝	5.102	6¼	3⅝		2⅞	7	3
3¼	8	7.487	5	5.515	6⅝	3¾		3	7¼	3¼
3½	8	8.749	5⅜	5.928	7⅛	4⅛		3¼	8	3½
3¾	8	10.108	5¾	6.341	7⅝	4 7/16		3½	8⅝	3¾
4	8	11.566	6⅛	6.755	8⅛	4⅝		3⅝	9	4



Nut dimensions are based on American National Standard B18.2.2

Threads are National Coarse series below 1 inch and eight-pitch thread series 1 inch and above.

Standards Of The Tubular Exchanger Manufacturers Association

Stainless and Non-Ferrous Torque Chart (Inch Pounds)

Size	SS 18.8	SS 316	Monel	Brass	Bronze	Aluminum 2024-T4	Nylon
2-56	2.5	2.6	2.5	2.0	2.3	1.4	0.44
2-64	3.0	3.2	3.1	2.5	2.8	1.7	
3-48	3.0	4.0	4.0	3.2	3.6	2.1	
3-56	4.4	4.6	4.5	3.6	4.1	2.4	
4-40	5.2	5.5	5.3	4.3	4.8	2.9	1.99
4-48	6.6	6.9	6.7	5.4	6.1	3.6	
5-40	7.8	8.1	7.8	6.3	7.1	4.2	
5-44	9.4	9.8	9.6	7.7	8.7	5.1	
6-32	9.6	10.1	9.8	7.9	8.9	5.3	2.14
6-40	12.1	12.7	12.3	9.9	11.2	6.6	
8-32	19.8	20.7	20.2	16.2	18.4	10.8	4.3
8-36	22.0	23.0	22.4	18.0	20.4	12.0	
10-24	22.8	23.8	25.9	18.6	21.2	13.8	6.61
10-32	31.7	33.1	34.9	25.9	29.3	19.2	
1/4"-20	75.2	78.8	85.3	61.50	68.8	45.6	16.0
1/4"-28	94.0	99.0	106	77.0	87.0	57.0	20.8
5/16"-18	122	138	149	107	123	80	34.9
5/16"-24	142	147	160	116	131	86	
3/8"-16	236	247	266	192	219	143	
3/8"-24	259	271	294	212	240	157	
7/16"-14	376	393	427	317	349	228	
7/16-20	400	418	451	327	371	242	
1/2"-13	517	542	584	422	480	313	
1/2"-20	541	565	613	443	502	328	
9/16"-12	682	713	774	558	632	413	
9/16"-18	752	787	855	615	697	456	
5/8"-11	1110	1160	1330	907	1030	715	
5/8"-18	1244	1301	1482	1060	1154	798	
3/4"-10	1490	1558	1790	1220	1382	958	
3/4"-16	1530	1582	1832	1249	1416	980	
7/8"-9	2318	2420	2755	1895	2130	1490	
7/8"-14	2328	2430	2775	1905	2140	1495	
1"-8	3110	3250	3730	2545	2885	1995	
1"-14	3440	3595	4130	2815	3185	2205	
1-1/8"-7	4680	4896	5640	318	3816	3012	
1-1/8"-12	4956	5184	5988	337	4596	3180	
1-1/4"-7	5760	6048	6900	394	5364	3696	
1-1/4"-12	6276	6552	7524	428	5820	4032	
1-1/2"-6	8436	8784	10080	575	7812	5400	
1-1/2"-12	10656	11160	12768	727	9864	6840	

*The above estimated torque calculations are only offered as a guide. Use of its content by anyone is the sole responsibility of that person and they assume all risk. Due to many variables that affect the torque-tension relationship like human error, surface texture, and lubrication the only way to determine the correct torque is through experimentation under actual joint and assembly conditions.

Bolt Torque Chart
Suggested Starting Values

The below estimated torque calculations are only offered as a guide. Use of its content by anyone is the sole responsibility of that person and they assume all risk. Due to many variables that affect the torque-tension relationship like human error, surface texture, and lubrication the only way to determine the correct torque is through experimentation under actual joint and assembly conditions.

ASTM A307

Bolt Size	TPI	Proof Load (lbs)	Clamp Load (lbs)	Tightening Torque (ft lbs)		
				Waxed	Galv	Plain
1/4	20	1145	859	2	4	4
5/16	18	1886	1415	4	9	7
3/8	16	2790	2093	7	16	13
7/16	14	3827	2870	10	26	21
1/2	13	5108	3831	16	40	32
9/16	12	6552	4914	23	58	46
5/8	11	8136	6102	32	79	64
3/4	10	12024	9018	56	141	113
7/8	9	15200	11400	83	208	166
1	8	20000	15000	125	313	250
1 1/8	7	25200	18900	177	443	354
1 1/4	7	32000	24000	250	625	500
1 3/8	6	38100	28575	327	819	655
1 1/2	6	46400	34800	435	1088	870
1 3/4	5	68400	51300	748	1870	1496
2	4 1/2	90000	67500	1125	2813	2250
2 1/4	4 1/2	117000	87750	1645	4113	3291
2 1/2	4	144000	108000	2250	5625	4500
2 3/4	4	177480	133110	3050	7626	6101
3	4	214920	161190	4030	10074	8060
3 1/4	4	255600	191700	5192	12980	10384
3 1/2	4	299880	224910	6560	16400	13120
3 3/4	4	347760	260820	8151	20377	16301
4	4	398880	299160	9972	24930	19944

SAE GRADE 2

Bolt Size	TPI	Proof Load (lbs)	Clamp Load (lbs)	Tightening Torque (ft lbs)		
				Waxed	Galv	Plain
1/4	20	1750	1313	3	7	5
5/16	18	2900	2175	6	14	11
3/8	16	4250	3188	10	25	20
7/16	14	5850	4388	16	40	32
1/2	13	7800	5850	24	61	49
9/16	12	10000	7500	35	88	70
5/8	11	12400	9300	48	121	97
3/4	10	18400	13800	86	216	173
7/8	9	15200	11400	83	208	166
1	8	20000	15000	125	313	250
1 1/8	7	25200	18900	177	443	354
1 1/4	7	32000	24000	250	625	500
1 3/8	6	38100	28575	327	819	655
1 1/2	6	46400	34800	435	1088	870

ASTM A325 / ASTM A449 / SAE GRADE 5

Bolt Size	TPI	Proof Load (lbs)	Clamp Load (lbs)	Tightening Torque (ft lbs)		
				Waxed	Galv	Plain
1/4	20	2700	2025	4	11	8
5/16	18	4450	3338	9	22	17
3/8	16	6600	4950	15	39	31
7/16	14	9050	6788	25	62	49
1/2	13	12050	9038	38	94	75
9/16	12	15450	11588	54	136	109
5/8	11	19200	14400	75	188	150
3/4	10	28400	21300	133	333	266
7/8	9	39250	29438	215	537	429
1	8	51500	38625	322	805	644
1 1/8	7	56450	42338	397	992	794
1 1/4	7	71700	53775	560	1400	1120
1 3/8	6	85450	64088	734	1836	1469
1 1/2	6	104000	78000	975	2438	1950
1 3/4	5	104500	78375	1143	2857	2286
2	4 1/2	137500	103125	1719	4297	3438
2 1/4	4 1/2	178750	134063	2514	6284	5027
2 1/2	4	220000	165000	3438	8594	6875
2 3/4	4	271150	203363	4660	11651	9321
3	4	328350	246263	6157	15391	12313

ASTM A193 B7

Bolt Size	TPI	Proof Load (lbs)	Clamp Load (lbs)	Tightening Torque (ft lbs)		
				Waxed	Galv	Plain
1/4	20	3350	2513	5	13	10
5/16	18	5500	4125	11	27	21
3/8	16	8150	6113	19	48	38
7/16	14	11150	8363	30	76	61
1/2	13	14900	11175	47	116	93
9/16	12	19100	14325	67	168	134
5/8	11	23750	17813	93	232	186
3/4	10	35050	26288	164	411	329
7/8	9	48500	36375	265	663	530
1	8	63650	47738	398	995	796
1 1/8	7	80100	60075	563	1408	1126
1 1/4	7	101750	76313	795	1987	1590
1 3/8	6	121300	90975	1042	2606	2085
1 1/2	6	147550	110663	1383	3458	2767
1 3/4	5	199500	149625	2182	5455	4364
2	4 1/2	262500	196875	3281	8203	6563
2 1/4	4 1/2	341250	255938	4799	11997	9598
2 1/2	4	420000	315000	6563	16406	13125
2 3/4	4	468500	351263	8050	20124	16100
3	4	567150	425363	10634	26585	21268
3 1/4	4	674500	505875	13701	34252	27402
3 1/2	4	791350	593513	17311	43277	34622
3 3/4	4	917700	688275	21509	53771	43017
4	4	1052600	789450	26315	65788	52630

ASTM A354-BD / ASTM A490 / SAE GRADE 8

Bolt Size	TPI	Proof Load (lbs)	Clamp Load (lbs)	Tightening Torque (ft lbs)	
				Waxed	Plain
1/4	20	3800	2850	6	12
5/16	18	6300	4725	12	25
3/8	16	9300	6975	22	44
7/16	14	12750	9563	35	70
1/2	13	17050	12788	53	107
9/16	12	21850	16388	77	154
5/8	11	27100	20325	106	212
3/4	10	40100	30075	188	376
7/8	9	55450	41588	303	606
1	8	72700	54525	454	909
1 1/8	7	91550	68663	644	1287
1 1/4	7	120000	90000	938	1875
1 3/8	6	138600	103950	1191	2382
1 1/2	6	168600	126450	1581	3161
1 3/4	5	228000	171000	2494	4988
2	4 1/2	300000	225000	3750	7500
2 1/4	4 1/2	390000	292500	5484	10969
2 1/2	4	480000	360000	7500	15000
2 3/4	4	517650	388238	8897	17794
3	4	626850	470138	11753	23507
3 1/4	4	745500	559125	15143	30286
3 1/2	4	874650	655988	19133	38266
3 3/4	4	1014300	760725	23773	47545
4	4	1163400	872550	29085	58100

Notes:

1. Values calculated using industry accepted formula T = KDP where T = Torque, K = torque coefficient (dimensionless), D = nominal diameter (inches), P = bolt clamp load, lb.
2. K values: waxed (e.g. pressure wax as supplied on high strength nuts) = .10, hot dip galvanized = .25, and plain non-plated bolts (as received) = .20.
3. Torque has been converted into ft/lbs by dividing the result of the formula by 12
4. All calculations are for Coarse Thread Series (UNC).
5. Grade 2 calculations only cover fasteners 1/4"-3/4" in diameter up to 6" long; for longer fasteners the torque is reduced significantly.
6. Clamp loads are based on 75% of the minimum proof loads for each grade and size.
7. Proof load, stress area, yield strength, and other data is based on IFI 7th Edition (2003) Technical Data N-68, SAE J429, ASTM A307, A325, A354, A449, and A490.

7 OPERATION

7.1 Definition

Operation Procedures must be strictly followed in start-up and shut-down sequences. Heat exchangers should not be subjected to abrupt temperature fluctuations. Hot fluid must not be introduced when the unit is cold, nor cold fluid introduced when the unit is hot.

7.2 Start Up & Operation

Commissioning may only be done by staff which has been trained specially for the job or by Alstrom commissioning engineers.

Control, maintenance and repair of the installation may only be done by authorized, trained and properly instructed staff.

Maintenance and cleaning may only be done with a shut down heat exchanger.

Check if all connections are fitted correctly.

Check the pressures and temperatures of the media and make sure that these are not more than the values specified on the identification plate.

It is essential that the heat exchanger is not subjected to thermal or mechanical shock as this could lead to premature gasket failure

Check system for cleanliness to avoid plugging of tubes and pass partitions with refuse. Protective screens or strainers in piping to the heat exchanger are recommended.

Vent valves should be opened before fluid is admitted to heat exchanger.

Check all flange bolting for tightness.

Start flow of fluids gradually, introducing colder fluid first. When system is completely filled and all air vented, close vent valves.

When operating temperatures are reached, bolting and packed joints should be retightened to prevent leaks and gasket failures.

The heat exchanger should never be operated at pressures, temperatures and flows in excess of those specified on the nameplate and design specification sheet.

For heat exchangers used in steam service, provision must be made to drain accumulated condensate prior to start-up.

Be sure that all parts of the system are clean and in proper operating condition. An exchanger cannot perform properly unless all connected equipment is functioning properly; yet, the exchanger is frequently blamed for nonperformance when the actual trouble is elsewhere in the system.

Observe the following precautions to obtain maximum performance:

- Exchanger must be full of fluid in both shell and tube sides.
- Provide periodic venting if air tends to accumulate in system.
- Maintain rated flow of both mediums.
- Avoid excessive flow of cooling water in exchangers used as coolers. It is a frequent cause of tube failure through erosion, and may decrease cooling efficiency, especially with heavy oils.
- Inspect exchanger periodically and clean thoroughly when necessary, especially inside tubes.

7.3 Shut-Down

Most heat exchangers with removable tube bundles may be shut-down by gradually reducing the flow of the hot medium and then the cold medium.

THERMAL SHOCK
Extreme caution must be taken to avoid subjecting the heat exchanger to thermal shock, excessive pressures and temperatures. These conditions can impose stresses resulting in premature heat exchanger failure as well as other components in the system.

Under no circumstances should there be pulsating of fluids, as this causes vibrations that could damage the structural integrity of the heat exchanger. The system should be designed to prevent the unit from encountering pressure shocks and rapid temperature changes.

MAINTENANCE

8.1 Regular Inspection

Typically, the failure of a heat exchanger to perform to specifications may be caused by one or more of the following factors: Excessive fouling, air or gas binding resulting from improper piping installation or lack of suitable vents, operating conditions differing from design conditions, excessive clearances between the baffles and shell and/or tubes due to corrosion.

Inspection of Alstrom Heat Transfer LLC equipment at regular intervals, as frequently as experience indicates, can identify potential problems before any structural damage occurs. The inspection should include an examination of both the interior and exterior of the unit.

Failure to keep all tubes clean can result in severe flow restrictions through some tubes which could cause damaging thermal stresses, resulting in leaking tube joints or structural damage to other components.

Temperatures and pressures of the fluid entering and leaving the equipment should be checked regularly to evaluate the function of the unit. For example, an increase in the pressure drop across the unit – with an accompanying decrease in the temperature range may indicate vapor or gas binding.

A slight sludge or scale coating on the tube greatly reduces the heat transfer efficiency. Therefore, exchangers subject to fouling or scaling should be cleaned periodically. A marked increase in pressure drop and/or reduction in performance usually indicate cleaning is necessary.

Frequently and at regular intervals, observe interior and exterior condition of all tubes and keep them clean. Neglect in keeping all tubes clean may result in complete stoppage of flow through some tubes, with consequent overheating of these tubes as compared to surrounding tubes, resulting in severe expansion strains and leaking tube-to-tube-sheet joints.

8.2 Cleaning

Provide convenient means for frequent cleaning of heat exchangers as suggested below:

Circulating hot wash oil or light distillate through tubes or shell at a good velocity will usually effectively remove sludge or similar soft deposits.

Soft salt deposits may be washed out by circulating hot fresh water.

Some commercial cleaning compounds such as “Oakite” or “Dowell” may be effective in removing more stubborn deposits. Use in accordance with the manufacturer’s instructions.

We advise you to ask for a confirmation from the supplier of the cleaning detergent that it will not damage the materials in the heat exchanger.

If none of the above described methods are effective for the removal of hard scale or coke a mechanical means may be used. When the heat exchanger is cleaned, it is important the full characteristics of the fouling material and the cleaning agent be known and care exercised in handling them according to instructions.

Do not attempt to clean tubes by blowing steam through individual tubes. This overheats the tube and results in severe expansion strains and leaking tube-to-tube-sheet joints

Do not blow out heat exchanger with air when fluids normally handled are of an inflammable nature.

Do not open heads until all pressure is off equipment and the unit is drained.

Do not handle tube bundles with hooks or other tools which might damage tubes. Bundles should be moved about on cradles or skids.

Do not tighten bolts until gasket is positioned properly. This precaution will eliminate one cause for taking down units because of leaks.

CAUTION: Since many of the removable components of the heat exchanger, particularly in the larger sizes are too heavy for men to handle care must be used to take this weight with proper rigging to avoid injury.

When a heat exchanger is dismantled for any cause, it is recommended that new gaskets be used in re-assemble. This will tend to lessen the possibility of future leaks because composition gaskets become brittle and dry out, they do not provide an effective seal when reused.

Metal or metal jacketed gaskets when compressed initially tend to match their gasket contact surfaces. In doing so, they are work hardened to the point that their reuse provides an imperfect seal and possible damage to the gasket contact surfaces of the heat exchanger.

To clean or inspect inside of tubes, remove channel covers (or bonnets). Do not remove channels.

CAUTION: Cleaning compounds may cause injury to exposed skin, eyes, and mucous membranes. Use of protective eyewear and gloves is strongly recommended**.**

8.3 Leaks

To locate leaking joints between tube and tube sheet or a split tube, proceed as follows:

Channel Type

- Remove channel covers
- Apply hydraulic pressure in shell

Bonnet Type

- Remove bonnets
- Bolt test rings in place with gaskets and packing
- Apply hydraulic pressure in shell

Use only cold water for hydrostatic test. The point where the water escapes indicates the defective tube or joint.

CAUTION: Ensure unit is depressurized and drained of hot and/or aggressive product before unit is opened to prevent personal injury.

When steel cables are used for lifting, the cable is threaded through one tube and returned through another. Loops are formed in the ends of the cable by use of thimbles and wire rope clips. A wood spreader block is inserted between the cable and the floating tube sheet to prevent crushing on tube end.

If the tube bundle has been in service for a considerable length of time without being removed it may be necessary to use a hydraulic jack on the floating tube sheet to get it started. A good sized steel bearing plate should be inserted between jack and tube sheet and the tube ends protected by means of a filler board.

CAUTION: Sharp Edges. When handling metal, gloves should be worn.

Tube bundles may be raised horizontally by means of slings. Baffles can be easily bent & damaged by dragging a bundle over a rough surface. Diameter of baffles is practically the same as the inside of the shell and a close fit must be maintained for the apparatus to function properly. Any damage to baffles should, therefore, be carefully avoided.

Tube Expanding a suitable tube expander can be used to seal a leaking tube joint; however, care should be taken to insure that tubes are not over expanded. Proper care should be taken to prevent expanding the tube beyond the backside of the tubesheet.

CAUTION: When removing the tube bundle…

• Do not exceed stated load capacities of any piece of equipment or tools used.
• Wear and/or follow all recommended protective clothing and other safety practices.

8.4 Gaskets

Gaskets and gasket surfaces should be thoroughly cleaned and should be free of scratches and other defects.

Gaskets should be properly positioned before attempting to retighten bolts. It is required that when a heat exchanger is dismantled for any cause, that it be reassembled with new gaskets. This will tend to prevent future leaks and/or damage to the gasket seating surfaces of the heat exchanger.

Composition gaskets become dried out and brittle so that they do not always provide an effective seal when reused. Metal or metal jacketed gaskets, when compressed initially, flow to match their contact surfaces. In so doing they are work hardened and, if reused, may provide an imperfect seal or result in deformation and damage to the gasket contact surfaces of the exchangers.

Bolted joints and flanges are designed for use with the particular type of gasket specified. Substitution of a gasket of different construction or improper dimensions may result in leakage and damage to gasket surfaces. Therefore, any gasket substitutions should be of compatible design.
Any leakage at a gasketed joint should be rectified and not permitted to persist as it may result in damage to the gasket surfaces and avoid the warranty.

Metal jacketed type gaskets are widely used. When these are used with a tongue and groove joint without a nubbin, the gasket should be installed so that the tongue bears on the seamless side of the gasket jacket. When a nubbin is used, the nubbin should bear on the seamless side.

10 TRANSPORTATION & STORAGE

10.1 Transportation

During transportation of the heat exchangers, ensure that they are not exposed to mechanical damage. Upon receipt of the unit, inspect for shipping damages. Notify the carrier and Alstrom Heat transfer LLC immediately in the event damages do occur.

10.2 Storage

Heat exchangers should be stored in a clean, dry, low humidity area away from corrosive environments or weather elements (rain, snow etc.). If the unit is not to be placed in immediate service, appropriate precautions should be taken to prevent rusting and/or contamination. Heat exchangers that are out of service for extended periods of time should be protected against corrosion.

11 AFTER SALES SERVICE

11.1 Ordering parts

When ordering parts it is important that the correct details are given. At least the following should be quoted:

- Alstrom Serial number
- Exchanger model
- Required parts

ALSTROM HEAT TRANSFER LLC
TERMS, CONDITIONS & WARRANTY

1408 Seabury Avenue◆Bronx NY 10461◆Ph: 718.824.4901◆Fax: 718.409.3605◆E-Mail: info@ alstromcorp.com◆Web: www.alstromcorp.com

1. GENERAL TERMS
Binding Contract. Unless otherwise noted in the Seller's proposal, this proposal shall lapse automatically upon the expiration of a thirty (30) day period after the date of its submission unless it has been previously accepted by Purchaser or revoked in writing by Seller. This proposal does not become a binding contract until Seller confirms the Purchaser's order in writing.

Plans, Drawing and Illustrations. Proposal pages, catalogue illustrations and preliminary drawings are submitted only to show the general style, arrangement and approximate dimensions of equipment. Seller reserves the right to make such changes of design, construction or arrangement as it deems necessary to achieve the specifications contained herein. Purchaser is to provide the drawings of all foundations, concrete construction and reinforcement and required housings, based upon Seller's equipment drawings.

Proprietary and Confidential Information. This proposal and all drawings, notebooks, operating data, specifications, and other information, data and material (whether orally disclosed, printed, handwritten, typed, numerically or computer generated, computer stored, or otherwise) furnished to Purchaser by either Seller or any of its subcontractors or subsuppliers shall remain the proprietary and confidential property of Seller or the subcontractor or subsupplier, respectively, and shall be used by Purchaser only with respect to the work covered by the contract and shall not be used by Purchaser in connection with any other project. Such proprietary and confidential information and data shall not be shown or otherwise made available to any third party at any time without Seller's prior written consent. Neither Purchaser itself shall, nor shall Purchaser permit any third party to, reverse engineer, measure or otherwise technically examine or test Seller's equipment without Seller's prior written consent. Any such proprietary and confidential information which Purchaser determines must be disclosed to its employees, shall only be disclosed to its employees on a need-to-know basis for the operation, maintenance, and repair of the equipment provided under the contract. Intellectual property or patent rights which may be obtained on the basis of the information given or made available to Purchaser under the contract or with respect to Seller's equipment shall remain the exclusive property of Seller or its subcontractor and/or subsupplier, respectively.

2. SAFETY REQUIREMENTS OF PURCHASER
Purchaser shall use, and shall train and require its employees to use and shall cause any end user to use, all safety devices, guards, and proper safe operating and maintenance procedures as prescribed by all applicable laws, rules, regulations, codes and standards and as set forth in operating and maintenance manuals and instruction sheets furnished by Seller. Purchaser shall not, and shall cause any end user not to, remove or modify any safety device, guard or warning sign. If the Purchaser fails to strictly observe any of the obligations set forth in the preceding two sentences with regard to any of Seller's equipment, Purchaser agrees to defend Seller against, and indemnify and save Seller harmless from, any claim, liability or obligation (including the costs and attorneys' fees of any suit or claims related thereto) incurred by Seller as a result of persons being injured or property being damaged directly or indirectly in connection with the operation of such equipment as a result of such failure. Purchaser also agrees to indemnify and save Seller harmless from, any claim, liability or obligation incurred by Seller as a result of persons being injured or property being damaged due to Purchaser's use of Seller equipment for materials or products not specified in the contract or use of non-original replacement parts not specifically authorized in writing by Seller or due to changes in the Seller equipment made by Purchaser without Seller's specific written authorization.

3. CHANGE REQUESTS
The Purchaser has the right to ask for variation in the scope of supply. To this end the Purchaser shall inform the Seller in due time in writing about any details of such demand ("Change Request"). The Seller shall, within 10 working days from the reception of the Change Request, make an offer in writing to the Purchaser regarding the performance of the demanded variations (additional purchase price, modified delivery periods etc.). If a longer period of time from 10 days is required to determine the delay or cost increase necessitated by the change, then the Seller must advise the Purchaser within such 10 days and proceed diligently thereafter to determine the additional costs and time required. In case the Purchaser accepts said offer the Seller shall be obliged to perform the agreed modifications subject to changes being made to the purchase order or contract to reflect the Seller's response to the Change Request. Notwithstanding the foregoing, the Seller shall not be required to accept any change which the Seller believes in good faith is technically impossible or unsafe, then the change will not be made.

4. COMPLIANCE WITH LAWS
The equipment or work purchased from Seller shall comply with all applicable laws, rules, regulations, codes and standards of all federal, state, local and municipal governmental agencies having applicable regulatory jurisdiction, as such laws, rules, regulations, codes and standards are in effect on the date of the contract, provided that: (i) the Purchaser will include in its specifications or will bring to the attention of Seller in writing any state, local or municipal laws, rules, regulations, codes or standards which are different from those imposed by the federal governmental agencies and authorities; (ii) if any such federal, state, local or municipal laws, rules, regulations, codes or standards are changed, or if new laws, regulations, codes or standards or interpretations thereof are enacted or adopted subsequent to the date of the contract, which require a change in Seller's equipment or work, an equitable adjustment shall be made to the contract price, delivery schedule and payment terms; and (iii) Seller does not guarantee any compliance with, nor will Seller incur any liability for failure of the equipment or work to comply with, any federal, state or local pollution control, effluent or utility control laws, rules, regulations, codes or standards.

5. PRICE AND PAYMENT
The purchase price shall be paid in accordance with the Seller's proposal. Any right to retain due payments or to set-off counterclaims shall be excluded unless any such claim or counterclaim of the Purchaser is undisputed or has been determined by a final judgment of the competent court or arbitration court.

Whatever the means of payment used, payment shall not be deemed to have been effected before the Supplier's account has been fully and irrevocably credited.

If the Purchaser fails to pay by the stipulated date, the Seller shall be entitled to interest from the day on which payment was due. The rate of interest shall be one and one-half percent (1-½%) per month until the payment is made in full. Additionally, if Seller is required to expend costs and expenses in collecting any payments, Purchaser shall reimburse the Seller for such costs of collection (including reasonable attorneys fees).

In case of late payment the Seller may suspend his performance of the contract until it receives payment. If the Purchaser has not paid the amount due within three months the Seller shall be entitled to terminate the contract by notice in writing to the Purchaser and to claim compensation for the losses and damages it has incurred.

6. TRANSPORTATION; INSURANCE; RISK OF LOSS
Where transportation costs are prepaid, equipment will be shipped to an unloading point designated by the Purchaser. Unloading, haulage from the designated unloading point and further necessary handling shall be at the Purchaser's risk and expense, independent of any installation services that may be requested by the Purchaser.

Shipping instructions are to be supplied by the Purchaser within 15 days after release of the purchase order by Purchaser. In the event Purchaser fails to supply shipping instructions, it shall be invoiced and Seller at its option may place the equipment in Seller's or any public or private storage facilities at the Purchaser's risk and expense.

Insurance. Purchaser accepts full responsibility for the safeguarding of all equipment delivered to the Purchaser until it is paid for in full. Until the contract price is paid in full, Purchaser shall provide and maintain insurance to the total value of the equipment delivered hereunder against all risks of fire and explosion in the names of Purchaser and Seller, as their respective interests may appear, and shall also provide and maintain such insurance to the above value against flood, earthquake, windstorm, cyclone, tornado, hurricanes, riot and strike and civil commotion.

Title; Right of Possession; Security for Payment. The parties mutually agree that the equipment specified herein shall at all times remain personal property regardless of the degree of its annexation to the real property and that the equipment shall not by reason of any annexation to real property become a part thereof or otherwise a fixture. Title and right of possession of such equipment shall remain in Seller at all times. Title shall pass to Purchaser in accordance with the delivery terms for the equipment. Without waiving any rights to elect to proceed under applicable lien laws, Seller reserves a security interest in the equipment and parts furnished by it. By accepting delivery of the equipment or parts, Purchaser grants to Seller a security interest in such equipment and parts to secure the full and prompt payment for such equipment and parts until the agreed price (including any notes therefor) for such equipment and parts has been fully paid in cash. In the event of default in payment, Seller shall have all rights of repossession and other rights available to a secured party under the laws applicable thereto. Any equipment or parts may be separated from real estate for purpose of repossession by Seller or by its agent without liability for such removal if the Purchaser is in default in payment. Seller is authorized to execute, deliver and file with the appropriate filing office or offices all assignments, financing statements and other documents which Seller may require to evidence or perfect such security interest in accordance with applicable laws.

7. SELLER'S REMEDIES
In the event of the insolvency of the Purchaser, Seller reserves the right to cancel the sale as well as the right to stop delivery of the goods and to resell same. Such a right shall not restrict or otherwise impair Seller's remedies for damages in the event of Purchaser's breach.

Should Purchaser fail to comply with the terms and conditions set forth herein, or if any writ or execution be levied on any of Purchaser's property, or a receiver be appointed, or if a petition in bankruptcy be filed by or against Purchaser, Seller may, upon election, demand the entire purchase price stated herein or may without notice or demand by process of law or otherwise, take possession of all or any of the equipment, wherever located, and retain all monies theretofore paid as compensation for the reasonable use of such equipment. If a contract arising from this proposal is breached and is placed in the hands of an attorney for collection of any balance due or enforcement of any other of Seller's remedies, Purchaser agrees to pay all reasonable attorneys' fees and other expenses involved therein paid or incurred by Seller. Purchaser hereby waives any and all claims, damages and demands against Seller arising out of the repossession, retention and repair as aforesaid. All rights and remedies contained herein are cumulative and not alternative.

Seller reserves all other rights and remedies available to it in the event of Purchaser's breach.

8. ASSIGNMENT
The Purchaser shall not have the right to assign the agreement without the written consent of Seller.

9. INCREASE IN COST OR PRICE
Unless otherwise noted in Seller's proposal, all prices quoted are subject to surcharges in accordance with the provisions posted on a monthly basis on the Seller's Internet site. If shipment should be delayed by Purchaser beyond sixty (60) days or as specified in the Seller's proposal, the price may be increased to the price in effect at the time the equipment is shipped.

10. SELLER'S LIABILITY; FORCE MAJEURE
Seller shall not be liable for loss or damage of any kind resulting from: (i) Purchaser failing to supply any necessary technical data, as required; (ii) Purchaser failing to supply the apparatus, materials and services required; (iii) any changes in designs or specifications made subsequent to acceptance of this proposal; (iv) failure of suppliers to furnish purchased material or auxiliary equipment within scheduled dates provided that the purchased material or auxiliary equipment was properly ordered and appropriately expedited; (v) by any other reason beyond its control; or (vi) any delay caused by late payments by Purchaser.

Seller shall attempt to overcome but shall not be liable for any loss or damage from delay in delivery of any equipment or completion of any work as a result of causes of any kind beyond the reasonable control of Seller, such as, but not limited to, strikes or other labor difficulties, war, riots, changes in laws and regulations and other acts of governmental authorities, inclement weather, fire, flood or unavoidable casualties, or any delays in transportation of materials, or inability to obtain timely delivery of materials from suppliers where such transportation or delivery has been properly procured and appropriately expedited. In the event of any such delay, Seller will notify the Purchaser within a reasonable time after Seller becomes aware of such cause of delay and it is agreed that the time for delivery or completion shall be extended for a period of time at least equal to the time lost by reason of the delay.

11. MATERIAL AND WORKMANSHIP WARRANTY
Seller warrants to the Purchaser that the equipment purchased from Seller is free from defects in material and workmanship for a period of twelve (12) months from the date of Purchaser's initial operation using the equipment but not more than eighteen (18) months from the date of delivery of the equipment provided that: (i) the equipment is installed in accordance with Seller's specifications and instructions and is used and maintained normally and properly in accordance with Seller's instructions as to maintenance and operation, as set forth in written operation and maintenance manuals and instruction sheets furnished by Seller; (ii) the equipment has not been changed without the prior written approval of Seller; (iii) Purchaser gives prompt written notice to Seller before the end of the warranty period specifying all alleged defects in the equipment purchased; and (iv) Purchaser preserves and turns over to Seller and permits reasonable inspection by Seller of all allegedly defective equipment, parts or items and access to the equipment to observe its startup, operation and maintenance.

This warranty shall not cover (i) any equipment furnished by Purchaser or any third party (other than a subcontractor of Seller), (ii) any defects arising from gaskets failure, corrosion, abrasion, fouling, scaling, water hammering, freezing or other operation outside of prescribed temperature or/and pressure ranges, or negligent attendance or faulty operation, (iii) ordinary wear and tear, or (iv) any defects caused by errors on the part of the Purchaser in not providing a suitable place in which the equipment is to be located, adequate foundation works, or adequate protection against influences within or outside the place where the equipment is to be located which may affect the equipment or its operation. Notwithstanding the warranty set forth above, Seller shall not warrant any equipment, where the vendor of such equipment (other than Seller) is specified by Purchaser, for a period longer than warranted by the vendor.

Seller's obligation under this warranty and any other warranty or guarantee which is part of the contract is strictly and exclusively limited to furnishing repairs or replacements for equipment or parts determined to be defective on inspection by an authorized representative of Seller. Notwithstanding this exclusive remedy, if it is ultimately determined that the remedy fails in its essential purpose, then any action which may be brought against Seller subject to the terms of the contract will be limited to 100% of the contract price for the purchased equipment for which the exclusive remedy has so failed. Seller assumes no responsibility and shall have no liability for any repairs or replacements by Purchaser without Seller's prior written authorization. If Seller did not originally install the equipment, Seller shall have no liability for the costs of removing or segregating any defective equipment so that the repairs or replacements can be made.

12. DAMAGES
NOTWITHSTANDING ANY OTHER PROVISION OF THE CONTRACT TO THE CONTRARY:

(A) SELLER'S AND ITS SUBCONTRACTORS' AND SUBSUPPLIERS' AGGREGATE RESPONSIBILITY AND LIABILITY, WHETHER ARISING OUT OF CONTRACT OR TORT OR ANY OTHER LEGAL CONTEXT OR THEORY, INCLUDING NEGLIGENCE AND STRICT LIABILITY, UNDER THE CONTRACT, INCLUDING, BUT NOT LIMITED TO, ALL CLAIMS FOR BREACH OF ANY WARRANTY OR GUARANTEE, FAILURE OF PERFORMANCE OR DELAY IN PERFORMANCE BY SELLER OR PERFORMANCE OR NON-PERFORMANCE OF THE PURCHASED EQUIPMENT SHALL NOT EXCEED THE CONTRACT PRICE FOR THE PURCHASED EQUIPMENT; PROVIDED, HOWEVER, THAT THIS LIMITATION WILL NOT APPLY TO ANY LIABILITY OF SELLER FOR DIRECT DAMAGES CLAIMED BY PURCHASER FOR PHYSICAL DAMAGE TO PURCHASER'S PROPERTY (OTHER THAN EQUIPMENT PROVIDED BY SELLER) OR FOR DIRECT DAMAGES CLAIMED BY THIRD PARTIES FOR SUCH THIRD PARTIES' PERSONAL INJURY OR PHYSICAL PROPERTY DAMAGE (FOR WHICH PURCHASER IS LIABLE) TO THE EXTENT CAUSED

(B) IN NO EVENT SHALL SELLER, ITS SUBCONTRACTORS OR SUBSUPPLIERS BE LIABLE IN CONTRACT OR IN TORT OR UNDER ANY OTHER LEGAL CONTEXT OR THEORY, INCLUDING NEGLIGENCE AND STRICT LIABILITY, FOR ANY SPECIAL, PUNITIVE, INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES OF ANY KIND OR CHARACTER, INCLUDING, BUT NOT LIMITED TO, LOSS OF USE OF PRODUCTIVE FACILITIES OR EQUIPMENT, COSTS OF PRODUCT RECALL, PLANT DOWNTIME, DAMAGE TO OR LOSS OF PRODUCT, CHEMICALS, CATALYSTS, FEEDSTOCK OR OTHER RAW MATERIALS, LOSS OF REVENUES OR PROFITS OR LOSS UNDER PURCHASES OR CONTRACTS MADE IN RELIANCE ON THE PERFORMANCE OR NON-PERFORMANCE OF THE PURCHASED EQUIPMENT, WHETHER SUFFERED BY PURCHASER OR ANY THIRD PARTY, OR FOR ANY LOSS OR DAMAGE ARISING OUT OF THE SOLE OR CONTRIBUTORY NEGLIGENCE OF THE PURCHASER, ITS EMPLOYEES OR AGENTS OR ANY THIRD PARTY.

TO THE EXTENT THAT SELLER OR THE PURCHASER MAKES ANY CLAIM UNDER ANY FRAUD OR TORT THEORY FOR THE PURPOSE OF CIRCUMVENTING THE LIMITATIONS AND DISCLAIMERS SET FORTH ABOVE AND IS UNSUCCESSFUL IN PREVAILING ON THOSE CLAIMS, IT HEREBY AGREES TO REIMBURSE AND INDEMNIFY THE OTHER PARTY FOR ALL ATTORNEYS' FEES AND EXPENSES AND COSTS INCURRED BY THE OTHER PARTY IN DEFENDING SUCH CLAIM.

13. ALTERATION – MODIFICATION
No waiver, alteration or modification of the foregoing terms and conditions, except as noted in the text of this proposal shall be valid unless made in writing and signed by an authorized representative of Seller.

14. PATENTS
Seller shall hold Purchaser harmless against any claim that Seller's equipment infringes United States apparatus patents, but Seller makes no representation or warranty, and Seller shall have no responsibility for any infringement or unfair competition resulting from, the use of Seller's equipment with the Purchaser's process, or in combination with other equipment not supplied by Seller.

15. PRODUCT SELECTION AND USE
The Purchaser shall be responsible for accurate design and operating conditions used in the selection and use of the Seller's products. The Purchaser's selection and use of Seller's products from published literature shall be at the Purchaser's risk as to appropriate application, design conditions and performance criteria use.

16. STANDARDS AND TOLERANCES
All product dimensions and published information is subject to change without notice. All of Seller's products furnished to the Purchaser shall also be subject to tolerances and variations consistent with usages of the trade concerning dimensions, composition and mechanical properties and normal variations in performance characteristics and quality.

17. INTEGRATION CLAUSE
By acceptance of this proposal, the Purchaser acknowledges (1) that it has not relied on any previous written, oral or implied representation, inducement or understanding of any kind or nature, (2) that Seller's proposal, including these General Terms and Conditions of Sale and any drawings incorporated in the proposal by reference, embodies the entire agreement between the Purchase and Seller and supersedes all prior agreements and understandings, both written and oral, among the parties with respect to the subject matter hereof, (3) that the contract entered into by acceptance of Seller's proposal by the Purchaser may not be modified or terminated except in writing signed by a duly authorized representative of Seller making specific reference to the contract, and (4) the Purchaser may not assign the contract without the prior written consent of Seller.

18. DISPUTE RESOLUTION; GOVERNING LAW
Any determination, agreement or performance which is disputed or cannot be made, resolved or agreed within fourteen (14) days of the date requested by either Purchaser or Seller or such longer period for resolution as may be mutually agreed shall be submitted for resolution by the chief executive officers of the Purchaser and the Seller. It shall be a condition precedent to any subsequent proceeding that the dispute shall be submitted for resolution by such chief executive officers, but if those officers shall not reach a resolution within twenty-one (21) days of submittal to them, then the matter shall be finally settled by arbitration under the Rules of the American Arbitration Association by one or more arbitrators appointed in accordance with such Rules. The place of arbitration will be Bronx, New York. The contract between the Seller and the Purchaser and their respective performances shall be construed under and governed by the laws of New York.

Alstrom Heat Transfer LLC

1408 Seabury Avenue, Bronx, NY 10461 USA
Ph: 718-824-4901 Fax: 718-409-3605
E-mail: info@alstromcorp.com

SHELL & TUBE HEAT EXCHANGERS
WARRANTY CLAIM

To file a claim under the warranty, the purchaser must do the following during the warranty period:

Before returning the product to Alstrom Heat Transfer LLC for warranty service, the purchaser must complete the Warranty Claim Form and fax it to **718-409-3605** or e-mail to **info@alstromcorp.com**. Upon preliminary assessment of the claim, Alstrom Heat transfer LLC will provide the purchaser with Return Merchandise Authorization Number. The RMA number must be clearly displayed and attached to the product on its return before it can be processed.

Proper packing of the product in the original container, or equivalent, is the responsibility of the purchaser. The warranty does not cover expenses or labor for disassembly, removal, shipment, reassembly or reinstallation; the purchaser will be responsible for such costs.

The Alstrom Heat Transfer LLC warrants the product against defects in materials and workmanship for a period of one (1) year from date of shipment/invoice. Should the product fail to perform according to the specifications set forth by Alstrom Heat transfer LLC during the warranty period, Alstrom will repair or replace, free of charge, the products that it finds defective.

If you wish to make a warranty claim, please complete this form. Incomplete forms will not be processed. To make multiple claims, please fell out form for each individual unit.

Contact Name: _____ **Company:** _____

Address: _____

Phone: _____ **Fax:** _____

E-Mail: _____

PRODUCT INFORMATION:

Model: _____ **Serial No:** _____

Date of Shipment or Invoice: _____

EXPLANATION OF FAILURE/SYMPTOMS OF DEFECT:

_____

_____

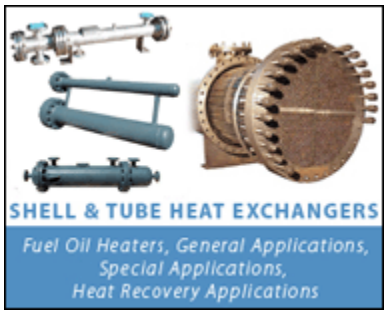
_____

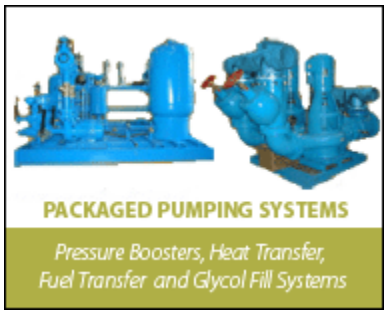
_____

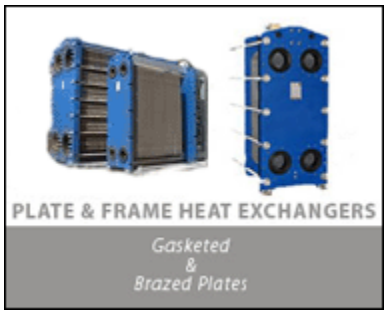
_____

_____

FOR OFFICE USE ONLY **Authorized by:** _____ (PRINT) **Signature:** _____	**RMA No:** _____ **Date:** _____







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· Heat Recovery Boilers
· Deaerators
· Pumping Systems
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· Heat Recovery Applications
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