TUBULAR
EXCHANGER
MANUFACTURERS
ASSOCIATION

TEMA

standards inquiries

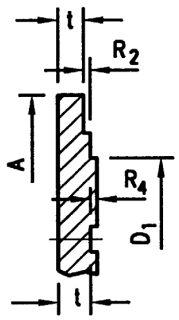
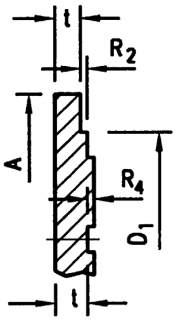
LAST REVISED 2.7.20

TEMA Standards Inquiries

Last revised February 7, 2020

Ninth Edition Updates and Corrections:

(Note: Version refers to the printing of the book and matches the first three digits of the book serial number. If your book has a higher number, then the change is already in the book.)

Version	Page	Description of Change
901	5.11-2	Paragraph RCB-11.4 (which is the same as it was in the Eighth Edition) had been inadvertently left out.
902	10-21	Paragraph RGP-RCB-10.7 revised: (πd2t) should be ($\pi d^2 t$) in three places
903	2-3	Dimension R3 was shown as 1/4" but should be 1/16"
903	3-7	G-7.13 REFERENCE (12) Moss, Dennis R., "Pressure Vessel Design Manual," 1987, Gulf Publishing Company. Changed to: (12) Moss, Dennis R., "Pressure Vessel Design Manual: Illustrated Procedures for Solving Major Pressure Vessel Design Problems" Edition: 3, Publisher: Gulf Pub Co (December 18, 2003)
903	10-20	Mr in figure RGP-RCB-10.6 changed to Mt for consistency with RGP-RCB-10.7
904	2-3	Figure F-3, in the top section, dimension D1 shown in leftmost part of Standard Confined Joint Construction was pointing at the wrong corner. Was:  Should be: 
906	5.4-2, 5.4-3	In Tables R-4.41 and CB-4.41 the conversion of 5/16" should be 7.9 mm not 7.5 mm
909	5.4-3	In Table CB-4.41, bottom row, the conversion of 5/8" should be 15.9 mm not 12.7 mm

Eighth Edition Inquiries:

subject/section (TEMA Inquiry Number)	question	reply
General (220)	1) Are removable shell covers required for single or multipass "T" type exchangers.	1) No. The "T" type defines the pull through type of floating head and not the shell cover being removable or integral.
	2) Can a test ring be manufactured for a "T" type design with a removable cover	2) Yes, plugs are provided for the bolt holes in the floating tubesheet. See Paragraph E-4.13(3)
N2 (234)	Is it acceptable to use "lap joint" type flanges for exchanger body flanges (parts nos. 3, 10,11,13,17 in TEMA figure N-2) ?	Yes, provided the provisions of the ASME Code are maintained.
(292) XX	Referring to Figure G-5.2(M), "HEAT EXCHANGER SPECIFICATION SHEET" Line 42 , shouldn't the notation "(Integ.) (Remov)", properly be on Line 43?.	No. The specification sheet is correct as written. For an example of an integral shell cover, please refer to Figure N-2 for type "CFU", item denoted "9". For an example of a removable shell cover, please refer to Figure N-2 for type "AES", item denoted "9"
WELDING of fixed tube sheet type heat exchanger (321)	On a one pass straight tube bundle, with two fixed tube sheets, BEM type, are we allowed to weld tube sheets to both shell and channels/bonnets? And is the unit then still called BEM type?	Yes, it is acceptable to weld tubesheets to both shell and channels. The unit type designation is still "BEM". However, we suggest the unit to be referred to as "BEM(all welded)" or "BEM(special)"
Section 2 (116)	Does TEMA set any tolerance regarding maximum rotation of the floating tubesheet with regard to the stationary tubesheet?	No
F-3 (219)	1.) Does Fig. F-3 refer to surface flatness?	1.) No. The tolerances in Section F-3 are for diameters and thickness relevant to tubesheets, partitions, covers and flanges and are not pertinent to gasket surface flatness.
	2.) Where does TEMA specify tubesheet flatness especially for pass partitions?	2.) Refer to Para. RCB-6.33 and RCB-6.4.
Section 2 F3 (229)	Is it permissible to use flange types other than shown in Figure F-3, Section 2 provided they meet ASME Code rules?	Yes

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Stacked Unit (313)	Does TEMA have a method for determining stresses/thicknesses in shells of heat exchangers that are stacked up to three (3) high?	TEMA does not currently provide rules for the design of supports for stacked exchangers. With reference to G-7.11, support design for the bottom unit should take into account the weight of the top unit(s) to prevent overstress in the shell or supports. In addition, bundle pulling force of the top unit(s) for removable bundles should be considered in design of supports for the bottom exchanger of stacked units. Calculation methods are the responsibility of the designer.
RCB-1 (227)	Are SA-249 tubes acceptable for a TEMA Class "C" exchanger?	Yes, materials should meet the requirements of the ASME Boiler and Pressure Vessel Code Section VIII, Div 1.
RCB 1.13,7.132,7.22 & 7.23 , ASME SEC.VIII Div.2 , ASME SEC.II Part-D Table 2A & 2B (282)	Is it acceptable to apply ASME Section II Part-D stress intensity values to an exchanger to be designed per ASME VIII Div. 2?	The standards are intended to apply only to exchangers designed to ASME VIII Div. 1. We refer the user to the Notes to Users of the TEMA Standards, on page viii of the standard for guidance.
RCB-1.13 (286)	May exchangers or parts of exchangers be designed to vessel codes other than ASME Section VIII, Div. I ?	In the Notes to Users of the TEMA Standards" (page viii of the Standards), exceptions to the Standards are allowed as long as there is agreement to the exception by the user and the exception is documented.

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SECTION 5 AND RCB 2.2 TUBE DIAMETER AND GAUGES RCB –2.21 BARE TUBES TABLE RCB-2.21 LISTS COMMON TUBE DIAMETERS AND GAUGES FOR BARE TUBE OF COPPER , STEEL AND ALLOY. OTHER DIAMETERS AND GAUGES ARE ACCEPTABLE (320)	regarding Table RCB-2.21 for bare tubes, which of the following interpretations is correct? INTERPRETATION 1: FOR THE DIAMTERS LISTED IN TABLE RCB 2.21 THE GAUGES MENTIONES ARE ONLY INFORMATIVE AND THE THICKNESS OF THE TUBE OR SELECTION OF GAUGE CAN BE BASED ON ASME SECTION 8 DIV. I PRESSURE CALCULATIONS. IN OTHER WORDS OTHER GAUGES (HIGHER OR LOWER) CAN BE USED FOR DIAMETERS LISTED .IN THE TABLE INTERPRETATION 2: FOR DIAMETERS LISTED IN TABLE RCB 2.21 THE GAUGES MENTIONED ARE MAXIMUM RECOMMENDED (THICKNESS MINIMUM) AND THE FREEDOM TO SELECT HIGHER GAUGES IS AVAILABLE ONLY FOR OTHER DIAMETERS I. E. DIAMETERS WHICH ARE NOT LISTED IN RCB 2.21	Interpretation 1 is correct
RCB-2.21 (228)	May a tube with wall thickness thinner than that listed under Paragraph RCB-2.21 be used provided it meets the requirements of the ASME code?	Yes.
RCB-2.31 U- bend requirement (108)	Should the minimum tube wall thickness (t1), be based on the the largest thickness calculated for internal or external pressure?	Yes
RCB -2.31 (311)	1) With reference to the 10% flatness tolerance for U-bends, what is the intent of the comment "U-bends formed from tube materials having low ductility…."?	1) The intent of this comment is to alert the user that U-tubes formed from materials of low ductility may require special bending techniques in order to meet the flatness tolerances. For more information, you may wish to consult tube suppliers, particularly those who furnish U-tubes to the power industry.
	2) Does a 0.75" OD U-tube with a measured diameter of 0.665 " at the bend meet TEMA "R" requirements?	2) No

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RCB-3.13 (118)	In the tables R-3.13 and CB 3.13 what is the correct thickness for intermediate values such as 750 mm(29.5 inch) nominal diameter?	See TEMA Paragraph N-1.11 for determining the nominal shell diameter. In the case of shell inside diameters with fractions of 12.7 mm(.5 inch) and less it is acceptable to round down to the nearest integer.
RCB-3.13 (326)	Minimum thickness requirement fro Carbon Steel from 30-100 Inch -12.7 mm which is very stringent. Some time actual thickness as per Section VIII div 1, is 8mm for given range of dia but we have to take 14 mm plate as 12.7 mm is not available and 12 mm is not acceptable. Can we use less thickness if agreed by our customer as per ASME section VIII.	As stated on page viii of the Standards, "Notes to Users of the TEMA Standards", exceptions to the Standards are allowed upon agreement between the purchaser and fabricator and such exceptions are documented
Table CB-3.13 (130)	1) Why do 20" and 22" shells required schedule 20 pipe (.375" wall) but plate can be .3125" thick?	1) Pipe Schedules for 20" and 22" shells are based on pipe schedule dimensions shown in Table D-1.
	2) Can pipe with .3125" wall thickness be used?	2) No, unless agreed upon between the Manufacturer and Purchaser.
RCB-3.2 (327)	In paragraph RCB-3.2 minimum shell cover thickness is according to table 3.13, but it is "before forming". We know that thickness of knuckle portion after forming is very depend of forming technique. However for design, after forming thickness is important and the before forming thickness is based on experience of each manufacturer. Please clarify which one is correct?	The nominal thickness of heads before forming must be at least equal to the values shown in Table R-3.13 and Table CB-3.13. The thickness of these heads after forming must, as a minimum, meet the thickness as required by the ASME Code, Section VIII, Div. 1.
RCB-4 (199)	What is meant by "intermediate support baffles"?	The term "intermediate support baffles" refers to tube supports in the bundle which do not affect the flow of the fluid. They are installed between baffles which direct the shellside flow. They are most often used in NTIW bundles in which case they have windows on both sides and are used to reduce the unsuppported span of the tube.

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(287)	In lieu of plate type segmental or multi-segmental type baffles, it acceptable to provide tube spacing/support using a lattice-work cables tensioned by a frame work?	Although this method of tube spacing/support is not directly addressed in TEMA, "other types" of baffle structures are allowed; however, design guidelines are for other types are not given in TEMA and sound engineering judgment should be exercised.
RCB -4 (302)	1) Is it mandatory to have horizontal baffle cut when nozzles are bottom inlet and top outlet on the shellside?	1) No
	2) Is bottom inlet/top outlet generally used or permitted with vertical baffle cuts?	2) It is permissible to have vertical baffle cuts with bottom inlet/top outlet. Specific questioning regarding recommendations of baffle orientation are not within the scope of TEMA and are left to the designer to exercise sound engineering judgment.
	3) Does having a vertical cut in the baffle in U-tube bundle help in reducing vibration?	3) Baffle cut and the corresponding tube layout angle are one of many variables effecting vibration. TEMA cannot address specific design questions or make recommendations concerning specific designs.
RCB-4.2 (142)	Is unsupported tube length in Paragraph RCB-4.2 based on the same defined unsupported tube length in Tables R-4.41 and CB-4.41?	Yes.
RCB 4.4 (238)	For TEMA 'F" type shell and for the purpose of determining baffle or support plate thickness, should the 'nominal shell ID' in Table R-4.41 be taken as the full nominal shell ID, or 1/2 the full nominal shell ID, or the hydraulic diameter due to presence of the longitudinal baffle?	The full nominal shell diameter (see TEMA paragraph N-1.11) shall be used
RCB 4.6 (203)	1. RCB 4.63 seems to require an impingement plate for tubeside liquid as a function of pv^2. What about other fluids?	1. RCB-4.63 does not require tubeside impingement plates for any case. It only recommends "special devices" to prevent erosion for high values of pv^2. These can be any of several devices including tube end inserts and distributor baffles. It probably should include vapors and two phase fluids as recommended.

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	2. RCB 4.61 requires shellside impingement plates for vapors and gases regardless of pv^2. Does this mean that other fluids have less erosion impact?	2. No. RCB-4.61 does not require impingement plates for all vapors and gases. It requires impingement plates for non-abrasive, single phase fluids where pv^2 is greater than 1500 and all other vapors and gases (that is, vapors and gases which are not non-abrasive and single phase). It does not require impingement plates for fluids (including gases and vapors) which are nonabrasive, single phase, and pv^2 less than 1500.
RCB- 4.63 (240)	In TEMA Paragraph RCB -4.63, is the V in the calculation for pV2 taken as the entrance line (nozzle) velocity or the in-tube velocity.	The entrance line (nozzle) velocity.
RCB 4.7 (288)	Can baffles be welded to inside shell instead of tying them with tie rod and spacers?	Yes; however, exercise caution to ensure that tubeholes are aligned in adjacent baffles.
RCB-5.141 Backing Device Thickness (Type S) (245)	For Styles "A" and "D" is the formula for bending correct or must the moment be multiplied by 2?	The formula for Styles "A" and "D" is correct as shown due to the limited rotation.
RCB 5.141 Style B (297)	In ASME Code Section VIII, Div. I , Appendix 2, Para. 2-5(e), which value of "W" shall be used?	The User is referred to ASME Code Section VIII, Div. 1, Appendix 2, Para. 2-3 for clarification
Outside packed floating (P) type exchanger (231)	What is the maximum allowable design pressure (shell side) for TEMA type " P" externally packed floating head exchanger?	TEMA recommends a maximum design pressure of 300 psi for type "P' floating heads. With agreement between fabricator and end user, and exercising of sound engineering practice or proven design experience, a higher design pressure can be used.
RCB 5.2., Outside Packed Floating Heads(Type P) (232)	Can outside packed floating head (TEMA type "P") be used at design pressure greater than 300 psi? If yes, what is the maximum allowable design pressure for TEMA "R" construction?	TEMA does not recommend Type "P" floating heads for greater than 300 psi design pressure. With mutual agreement between fabricator and end user, and with exercising of sound engineering judgment or proven design experience, it is acceptable to exceed 300 psi design pressure.

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RCB 5.2 (233)	Referring to Table RCB-5.22, what are the corresponding dimensions for type "P" exchangers in the size range of 60"-100"?	TEMA does not address sizes above 60" because TEMA does not recommend the type "P" floating head exchanger be used above 60" nominal size.
RCB 5.3 (319)	What is the allowable leakage rate past the lantern ring in an externally sealed floating head tubesheet?	This matter is not directly addressed in the TEMA Standards, but rather comes under the jurisdiction of the ASME Code. Please refer to the ASME Section VIII, Division l, paragraph UG-99(g) for further information
RB -5.31 (120)	Would it be acceptable to use a rear head type "W" with propane on the tube side?	No
(224)	After welding tubes to the tubesheet, what is the flatness tolerance for tubesheets with pass partitions?	See Paragraph R-6.33 and CB- 6.33
2-F-3 (278)	What is the flatness tolerance for the pass partition gasket surface area?	This tolerance is not specifically addressed in the Standards and we advise user to exercise sound engineering judgement. For guidance, we refer you to TEMA paragraphs RCB-6.3 and RCB-6.4
R-6.5, F-3 (277)	When using Standard B16.5 raised face flanges as body flanges in combination with gaskets confined on the OD with compression stop rings (such as Flexitallic Style CG), does this configuration meet the TEMA requirement for a confined joint?	Yes, See TEMA Figure RCB-6.5
RCB 6.5 (312)	Will any gasket type which includes an outer metal retaining ring meet the requirements of a "confined gasket" between two raised face flanges, or must the gasket be spiral wound type? For example, would Kammprofile Style ZA or ZG, IDT Style WS3885-DB also qualify as "confined" type?	Although TEMA cannot address specific designs or trademark products, any gasket with a solid metal outer retaining ring that prevents a direct radial leak path to the environment in the event of gasket extrusion or 'blowout" meets the intent of the TEMA "confined" joint.
RCB-7 (103)	Are Tubesheets designed as per ASME Section VIII, Division 1 acceptable to TEMA?	Upon agreement between purchaser and fabricator, exceptions to TEMA requirements are acceptable. An

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		exchanger may still be considered as meeting TEMA requirements as long as the exception is documented.
RCB-7.11 (304)	1)Does NTIW tubesheets fall within the scope of the TEMA tubesheet design procedure?	1) No
	2) Up to what baffle cut can it be considered that the tubes are uniformly distributed?	2) The TEMA Standard does not specify the requirements to qualify a tube layout as being "uniformly distributed." Therefore, the user may use his own judgment to determine whether the layout meets this requirement. The TEMA Technical Committee will consider whether this paragraph will include a qualification to define uniform distribution for the next edition of the TEMA Standard.
	3) Under what conditions are full diameter tubesheets provided with removable bundles? What is the reason for providing collar bolts?	3) The user's design specification will generally indicate whether the tubesheet is to be full diameter or extended only to the gasket outer diameter. The advantage of the full diameter tubesheet is that by using tapped holes or collar bolts, one joint (tubeside or shellside) can be opened without losing the seal on the other side.
R-7 (244)	1) For a DFU type exchanger, may the required tubesheet thickness be calculated per the rules for fixed tubesheets?	1) No. The configuration of a DFU type exchanger does not match the definition of a fixed tubesheet exchanger given in Paragraph RCB -7.16. Specifically, a DFU type exchanger does not have tubesheets fixed to both ends of the shell.
	2) Why is the constant 0.31 used in the formula for effective tubesheet thickness in Paragraph RCB-7.133?	2) The constant 0.31 used in Paragraph RCB-7.133 dates back to early editions of the TEMA standards and has been validated through many years of use.

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R 7.131 (279) (303)	1) Are the minimum tubesheet thickness requirements in R-7.131, C-7.131, and B-7.131 applicable for tubesheets with tube to tubesheet joints which are expanded only?	1) Yes
	2) Are the requirements of the above referenced paragraphs applicable to tubesheets with tube to tubesheet joints which are strength welded?	2) If the tubes are expanded in addition to the welding, then these paragraphs do apply. If the tubes are welded, but not expanded, these paragraphs do not apply
	3) Do these paragraphs include cases where the tubes are expanded lightly to close the gap and the expansion is not used to enhance the load capacity of the joint?	3) No (see RCB-7.522)
RCB 7.132 (127)	1) For a CEU type exchanger, is the pressure used to calculate the tubesheet thickness due to tubeside pressure = P= Pt + Pb ?	1) Yes
	2) In Paragraph RCB-7.13421, Method I, what Pressure "P" Should be used to calculate M*: Ps, Pt or the design pressure of the gasketed side?	2) In paragraph RCB-7.13421, Method 1, the design pressure of the gasketed side should be used to calculate M*
	3) When calculating the tubesheet thickness for a CEU type exchanger, should Pb be added to Ps when considering shellside pressure as well as to Pt when considering tubesheet pressure?	3) Yes
Table RCB-7.132 (209)	This question is in reference to Table RCB-7.132, Figure (d) and the definition of G in the table for the corresponding figure as applied to a fixed tubesheet exchanger with differing shell and channel IDs. When designing the extended portion of the fixed tubesheet for gasket seating and for operating conditions, should the moments on the extended portion be calculated based on the shell ID or channel ID?	G is defined in Table RCB-7.132 for two different conditions: Shell side pressure and tube side pressure. When a bolted-on channel is used on a fixed-tubesheet exchanger, as shown in Figure (d) of Table RCB-7.132, the moments acting on the extended portion of the tubesheet should be calculated based on the channel gasket G as stated in the column for "Tube Side Pressure." However, if the channel is integral with the tubesheet, the value for G should be taken as the channel ID for the tube side pressure condition. This is stated in Table RCB-7.132, although the channel ID is generically referred to in the table as

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		"shell ID." The phrase "shell ID if fixed tubesheet type unit" must be in reference to the channel ID for cases involving channels which are integral with the tubesheet, since this phrase is shown in the column for "Tube Side Pressure."
TEMA Inquiry Number: 01-209 (226)	This question is in response to the reply given for TEMA Inquiry 01-209. When calculating equivalent bolting pressures per Paragraph RCB -7.162, what should be taken for G in each of the following cases, assuming that all cases involve fixed tubesheet exchangers: a) Shell ID = Channel ID b) Shell ID > Channel ID c) Shell ID < Channel ID	1) Paragraph RCB -7.162 states that G is defined in Paragraph RCB -7.132. Paragraph RCB -7.132 states that for fixed tubesheet exchangers, G shall be the inside shell diameter. Therefore, for all three cases referenced in the question above, G shall be the shell inside diameter. However, the rules of these TEMA paragraphs were developed for cases in which the shell and channel inside diameters are identical or approximately identical. For cases in which the shell and channel diameters are significant different, good engineering judgment should be used in the selection of a value for G. Please note that this reply differs from the reply previously given for TEMA Inquiry 01-209 The reply given for TEMA Inquiry 01-209 is currently being re-examined by the Subcommittee on Tubesheet Design and may be subject to revision.
	2) Is it possible to construct a fixed tubesheet exchanger in which the channel is integral with the tubesheet?	2) Yes.
(235)	When calculating the tubesheet thickness for an AEU or BEU type exchanger with a flanged extension (as shown in Table RCB-7.132(b)), should Pb be added to Ps when considering shell side pressure and to Pt when considering tube side pressure?	Yes
RCB 7.132 (237)	For a CEP type exchanger, what value shall be used for F for the stationary and floating tubesheets, respectively?	Since the stationary tubesheet of a CEP type exchanger is integral with the channel, F for the stationary tubesheet shall be the value determined by the curve H in Figure RCB-7.132. (This value for F is

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		also shown in Table RCB-7.132 (C)) For the outside packed floating tubesheet, F shall be 1.0 as stated in Paragraph RCB 7.132 and Table RCB -7.132 (m)
Cooler Design to Meet PED Regulations (241)	When calculating the required tubesheet thickness per Paragraph RCB -7.132 for a floating tubesheet type exchanger, must the highest design pressure be considered with no pressure acting on the opposite side or can the tubesheet thickness be calculated for a differential pressure condition?	A stated in the definition for P in Paragraph RCB-7.132 differential pressure may be used in the calculation of tubesheet thickness if specified by the purchaser.
RCB Paragraph 7.132 Tubesheet Formula Bending (250)	1)This question is in regard to a BEU type exchanger with the tubesheet bolted between the channel and shell girth flanges. The tubesheet is equal in diameter to the adjacent girth flanges and has drilled-and-tapped bolt holes sized to accommodate the girth flange bolting. Does the configuration of this tubesheet match the definition in Paragraph 7.132 of a "tubesheet . . . . extended as a flange for bolting to heads or shells with ring type gaskets"?	1) Yes.
	2) Must the tubesheet be integral with either the channel or shell in order to be considered 'extended" ?	2) No.
	3) if the tubesheet bolt holes are not tapped, but are instead sized to allow the bolts to pass through without transferring loads to the tubesheet during normal operation, may the tubesheet be exempted from the requirement to consider Pb and M* in the calculation of required thickness?	3) No, unless special agreement is reached between the fabricator and purchaser to exempt the tubesheet calculation from this requirement and precautions are taken to ensure that the tubesheet will never be bolted independently to the channel or shell and pressurized.
RCB 7.132 (273)	In the case of a heat exchanger where the tubesheet is welded to a thick channel and thin shell, can the value of F used for the tubeside thickness calculation be based on the channel thickness?	Please see the note at the bottom of Fig. RCB-7.132, The value of F shall be the smaller of the two values calculated by using the tubeside and shellside wall/ID ratios This value of F shall be used for both shellside and tubeside thickness calculations.
RCB 7.132 (271)	Question:1 In the case of a fixed tubesheet heat exchanger with the same shellside and tubeside inside diameters where the tubesheets are welded to the shell and bolted to the channels (ref Table RCB-7.132 fig. (d) , what	Question 1 Reply: The shell ID (not channel shell ID) shall be used to calculate PBt and PBs.

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	value of G should be used to calculate the equivalent bolting pressures, PBt and PBs?	
	Question 2: For the above case, what value of G should be used to calculate the tubesheet thickness for bending?	Question 2 Reply : The shell ID (Not channel ID) shall be used to calculate the tubesheet thickness for both the tubeside calculation and the shellside calculation.
RCB-7.132 (280)	For the case where a tubesheet is bolted to a shell whose cross section is drilled for the bolt holes in lieu of using a flange, is it required to calculate the values of Pbt and Pbs in the calculation of the required tubesheet thickness?	If the configuration of the bolted joint is such that the bolt load imposes a moment on the tubesheet, then the Pb values must be calculated and included in the tubesheet thickness calculation. If the tubesheet is sandwiched between the channel and shell so that there is no moment on the tubesheet, then Pb need not be calculated. If the gaskets are full face gaskets, then Pb need not be calculated. For all cases, where bolting imposes a moment on the tubesheet and the gasket is the fulcrum, Pb must be calculated and included in the calculation.
Table RCB 7.132 (305)	Are "sandwiched" tubesheets as depicted in Table 7.132(b) to be designed with consideration for bolt loads?	Per Paragraph RCB-7.132, "For U-tube tubesheets (Type U), where the tubesheet is extended as a flange for bolting to heads or shells with ring type gaskets, P=Ps+Pb or Pt + Pb, depending upon the side under consideration." This paragraph requires that extended tubesheets used in U-tube exchangers must be designed with consideration for bolting loads. It is assumed that if the tubesheet is extended, that at some time in either operation, testing, or maintenance the tubesheet will be subjected to pressure without one of the backup flanges and will thus see the full effect of the bolting load.
Shell tubesheet joint (306)	What is the reason that the TEMA tubesheet design method does not calculate stresses at the tubesheet/channel and tubesheet/shell junction?	The TEMA method was developed to permit a designer to calculate the thickness of a tubesheet manually without requiring the use of a computer. To

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		accomplish this goal, certain simplifications were made in the design method. Figure RCB-7.132 provides a factor, F, as a function of wall thickness. This factor is used to stiffen the tubesheet and reduce the rotational deflection at the shell and channel joints when the wall thickness is small and could result in high joint stresses.
RCB7.132 (285)	For the case where the tubeside design pressure, Pt, is positive and the shellside is designed only for vacuum, what values of design pressure shall be used for the tubesheet thickness calculation?	Shellside design pressure: 0 psig Tubeside design pressure: Pt+15 psig
RCB-7.134 (317)	Shouldn't the Sl units for this paragraph be N/mm2 or mPa and N-mm in lieu of kPa and KN-mm?	Yes. It appears the Sl units used in this paragraph are inconsistent. This situation will be addressed in the next edition of the standards. Thank you for bringing this matter to the attention of the TEMA Technical Committee
RCB-7.134 (283)	What is meant by "tubesheet flanged extension" in Paragraph 7.134? Which configurations in Table RCB-7.132 include flanged extension which require thickness calculations?	A flanged extension refers to the tubesheet rim when it is supplied with bolt holes which when assembled will impart a bolting moment on the tubesheet. Configurations (b) and (c) in Table 7.132 have such flanged extensions. For configuration (b), the thickness of the flanged extension requires calculation if it is expected that the tubesheet will be operated or tested with one component (shellside or tubeside) attached and one component removed such that the tubesheet will be subjected to an overturning bolting moment.
RCB 7.1342 (131)	In Paragraph RCB-7.31421 (Method 1), is there a limit as to how much the assumed value of Tr can vary from the calculated value of Tr?	There is no limit as to how much the assumed value of Tr can vary from the calculated value of Tr in paragraph RCB-7.31421 (Method 1). The calculated

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		value of Tr in step (5) is the minimum thickness of the flanged extension of the tubesheet.
RCB7.1342 (322)	Is it required to calculate, for operating conditions, the thickness of the flanged extension of a tubesheet in a U-tube heat exchanger where the flanged extension is sandwiched between the tubeside and shellside flanges?	No, however it is recognized that if the tubesheet is supplied with a flanged extension, it is expected that the tubesheet will be subjected to an overturning moment by being bolted to either the tubeside flange alone or the shellside flange alone in a test situation. Therefore, the thickness of the flanged extension should be calculated using Pb for the test conditions.
RCB 7.15 (109)	In calculating the combined tubesheet thickness 'T' per paragraph RCB-7.13, what 'L' dimension should be used within the context of RCB-7.15: a) tube length between inner tubesheet faces (shell side tubesheets) or b) tube length between inner tubesheet faces (tubeside tubesheets)?	In calculating the combined tubesheet thickness 'T' per paragraph RCB-7.13, for use within the context of paragraph RCB-7.15, the dimension "L" shall be taken as the tube length between inner tubesheet faces of the shell side tubesheets.
RCB 7.1541 (252)	TEMA Paragraph RCB 7.1541 states that the minimum individual tubesheet thicknesses (t1 and t2) shall be the greater of Paragraphs RCB 7.13 or RCB 7.134, as applicable. Should the rules instead reference Paragraph RCB 7.131 (in lieu of RCB 7.13)?	Yes
RCB-7.1544 (221)	In cases where the total combined tube stress, sigma T is negative, should the absolute value be taken to compare to the code allowable stress, S?	Yes
RCB 7.161,1.432&1.431 (281)	Can we consider the average of the shell mean metal temperature and the tube mean metal temperature as the tubesheet mean metal temperature?	A method for calculating the tubesheet mean metal temperature is given in TEMA Paragraph T-4.33. If insufficient information is available to use this method, your method is acceptable as long as end user is in agreement.
RCB-7.161 and RCB-8 (101)	Note (1) under RCB-7.161 states that *J* can be assumed equal to zero for shells with expansion joints whose spring rates fall below a certain limit. This assumption results in a value of *Pd* = 0. If this value of *Pd* = 0 is then applied to the design of flexible shell elements as described in RCB-8, a stress equal to zero may be calculated for the flexible shell element for the	No. *J* may be assumed equal to zero ONLY for light guage bellows type expansion joints which meet the requirement of Note (1) under RCB 7.161. In no case shall *J* be assumed equal to zero when thick-walled flanged only or flanged-and-flued type expansion

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	deflection only (no pressure) case. This zero stress does not seem appropriate, since the flexible shell element must surely experience stress while in a state of deflection. Should *J* be assumed equal to zero for the design of flexible shell elements as described in RCB-8?	joints are used; rather, *J* shall be accordance with RCB 7.161 and RCB-8.6.
RCB- 7.161, 7.163, 7.164 (113)	A) In Paragraph RCB-7.163 and 7.164, the variable G is set equal to the port inside diameter for kettle type exchangers. Should Fq, as calculated in Paragraph 7.161, be calculated using this modified value of G when the exchanger in question is a kettle type?	A) YES. Per Paragraph RCB-7.161, G is defined in Paragraph RCB-7.132, which states that G shall be the port inside diameter for kettle type exchangers.
	B) In Paragraph RCB-7.161, what value of Es should be used to calculate Fq for a kettle type exchanger?	B) The modified value for Es shall be used for kettle type exchangers as shown in the "Notes" portion of Paragraph RCB-7.161
	C) In Paragraph RCB-8.52, is m determined from Figure RCB-8.51using ra or r'a? Similarly, in Paragraph RCB-8.54, should rb or r'b be used when entering Figure RCB-8.52 to determine the stiffness multiplier?	C) the curves of Figures RCB-8.51 and 8.52 are based on ratios of mean radius to thickness. Therefore, r'a and r'b should be used when calculating ratios for use in these curves. This is clarified in Paragraph RCB-8.5
	D) In Paragraph RCB-8.55, should tE be used in the determination of m and mo?	D) Yes.
RCB 7.161 (325)	Is it mandatory to make J= 0 if Sj< (Do-ts) ts Es/10L	No, the calculated value may be used.
RCB 7-163 (316)	What value dimension should be used fro Dj in Paragraph 7.163 when the expansion joint is a thin wall bellows type?	Dj should be the inside diameter of the convolution
shell with 2 material (307)	Does TEMA have design rules for shells of two different metallurgies?	The TEMA standards do not currently address the case of shells of two different metallurgies . If the exchanger is of fixed tubesheet construction, TEMA paragraph RCB-7.166 may be applicable.
RCB-7.23/24/25 (291)	What is the TEMA allowable tube stress in tension for transient operating conditions where most of the contribution to the loading of the tube is due to thermal expansion.	The requirements of Paragraph 7.23 do not differentiate between the stresses caused by thermal and mechanical loading. Even for a normal operating condition, the largest component of the tube stress

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		could be differential expansion between the tubes and the shell. In Paragraph RCB- 7.23, these loads are all lumped together and the stress limits expressed at the end of the paragraph apply regardless of whether the main contribution is mechanical or thermal. For all operating conditions, the longitudinal tube stress, St, is limited to the Code allowable stress limit at the Design temperature. Paragraph 7.24 considers only compressive stresses. Paragraph 7.25 considers only the effects of pressure loading, and thermal effects are excluded.
T-4, E-3.2 & RCB 7.2 (125)	1) How should the mean shell and tube metal temperatures be calculated for various operating and start up/shut down cases?	1)The determination of the mean metal temperatures should be based on the operating temperatures of both the shellside and tubeside fluids with due consideration given to such factors as the relative heat transfer coefficients of both fluids , the relative heat transfer area of parts in contact with both fluids, etc. Section T-4 may be used as a guide in determining the mean metal temperature. TEMA can not comment on specific applications.
	2) If the operating temperatures for alternate cases is less than the normal operating temperatures, can the allowable stress value of the shell/ tube/ tubesheet cab be taken at the lower temperature for those cases?	2) For multiple loading conditions, TEMA does not specify whether the allowable stress of the tubes and tubesheet be based on the highest of all design metal temperatures (RCB1.42) of individual cases or the respective design temperatures of each individual case. The selection of the appropriate allowable stress value is left up to the manufacturer.
RCB -7.42 (246)	Is the drill tolerance referenced in the notes of Tables RCB-7.42 and 7.42 M to be used only to calculate minimum standard ligaments?	Yes

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Tables RCB -7.42 and 7.42 M (251)	1) Is it permissible for any tubesheet ligament widths to be less than the "Minimum Permissible Ligament Width" given in the tables regardless of tubesheet thickness?	1) No.
	2) For tubesheets, which are thicker than 6" (152.4 mm), is the "Minimum Standard Ligament" equal to the value given for 6" (152.4 mm)?	2) No. For tubesheets which are thicker than 6" (152.4 mm) , the minimum Standard Ligament Width should be calculated per the notes for Tables RCB-7.42 & 7.42M.
	3) Is it allowable to extrapolate the tables for thickness greater than 6" (152.4 mm)?	3) Yes.
	4) Does a tubesheet with ligament widths less than the "Minimum Permissible Ligament Width" given meet TEMA's minimum requirements?	4) No.
(300)	What is the TEMA recommended minimum standard ligament and minimum permissible ligament per Table RCB-7.42M for a 50mm thick tubesheet, 17.2 mm OD tube and 21.5 mm pitch?	It is permissible to determine intermediate values in the table by interpolation. In this case, the recommended standard minimum ligament (96 % of holes) is 3.033 mm and the minimum permissible ligament is 2.060 mm.
RB-7.44 and C-7.44 (124)	In Paragraphs RB-7.44 and C-7.44, when utilizing hydraulic expansion, does the word 'grooves" mean that two grooves must be used regardless of tubesheet thickness?	In Paragraphs RB-7.44 and C-7.44 when utilizing hydraulic expansion, groove(s) shall be 1/4" (6.4mm) wide. Tubesheets with thicknesses less than 1 " (25.4mm) may be provided with one groove. Other groove configurations may be used based on recommendations of the expansion equipment manufacturer.
RB 7.44 (318)	A) Could you please provide some guidance (formulae, explanations) on how to calculate cross-over flow area between tube passes?	A) The specific formulae for calculating the cross-over flow areas is not within the scope of the current edition of TEMA; however , the cross-over flow area between two adjacent tube passes is generally taken as the cross sectional flow area of the floating head

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		taken in a plane perpendicular to the tubesheet and at the centerline between two adjacent tube passes.
	B) How does one calculate the ":flow area through the tubes in one pass:?	B) The flow area in one tube pass is the internal flow area of one tube multiplied by the number of tubes in that particular tube pass.
RCB-8.3 Expansion Joint Element Material Properties (156)	At what temperature are Es, Eo and Ee as defined by RCB-8.3 to be calculated?	Mean metal temperature.
RCB-8.5 (269)	Why was the stiffness multiplier added to the eighth edition??	Research performed by TEMA indicated inaccuracies in calculated stiffness value using equations in the seventh edition. Stiffness multipliers were developed through research and validated by FEA to ensure accurate calculation of stiffness of flexible shell element.
RCB-8.6 (299)	What are the units for Sj?	The units for Sj are lbs/inch or kN/mm , since Sj is the value of the overall spring rate for the entire flexible element.
RCB 8.7 &8.8 (289)	Is it required to consider Ps while calculating Theta A, Theta B, Za, Zb, Ma, Mb, A1, A2, A3, A4 etc. ?	Yes, it is required to consider Ps for all relevant equations as defined In Paragraph 8.81
RCB-8.82 Allowable stress on the annular plate element (112)	With regard to the annular plate of a flexible element, ASME Section VIII Div. 1, Appendix CC states that the allowable stress for the case of pressure plus axial deflection is K * S. Is this the allowable stress to be used for comparing Smbd calculated for the annular plate?	YES. Paragraph RCB-8.9 states that the allowable flexible element stresses shall be as defined by the Code, using an appropriate stress concentration factor for the geometry under consideration.
RCB-8.82 (270)	Which component is used to evaluate the cycle life of an expansion joint?	Both the annular and cylindrical elements must be checked when determining the expansion joint's cycle life. The component with the lower number of cycles governs the entire flexible shell element.

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Section 5, RCB - 8.82/8.9 (122)	Can the definitions and allowable stresses defined in Appendix 26 of the code be used for designing flexible shell elements as covered in RCB-8	NO. Appendix 26 of the code is intended for use in the design of light gauge bellows type expansion joints only. Allowable stresses for flexible shell elements such as flanged-only and flanged-and- flued expansion joints should be based on Appendix CC of the code.
BOTTOM HEAD MINIMUM THICKNESS (276)	For bonnets with two(2) different diameters, such as shown in user's inquiry sketch, do the TEMA rules for minimum thickness apply to both diameters?	Yes, both diameters must meet TEMA minimum thickness for the diameter under consideration.
RCB-9.12 (275)	For bonnets and channel head types not shown in TEMA such as those machined from flat plate or flanges, what guidelines should be used regarding minimum inside depth or cross -over area between passes?	The specified minimum inside depth for heads and channels is intended to provide for approximately equal flow distribution into the tubes, and also to help prevent erosion of the heads due to high flow velocities, Unless other means are used to accomplish
RCB-9.21 (201)	Should the thickness required for deflection be applied to the flanged portion.	No, but the flanged portion must not be less than that required by ASME Code Sect. VIII Div. 1.
RCB-9.21 (328)	I understand that nominal diameter for calculation of maximum channel cover deflection and channel inside diameter are the same with no difference, is it true?	Yes
R-10.3 Pipe Tap Connections (272)	Can 3000# couplings be used for TEMA "R" construction?	No. However, please refer to page viii, "Notes to Users of the TEMA Standards", wherein exceptions are allowed if acceptable to end-user and documentation of the exception is noted.
C- 11.1 (323)	Should minimum recommended metric bolt size for 1/2" be M12 or M14?	The correct metric bolt size equivalent to 1/2 " should be M12 and not M14 as stated in this paragraph. This error will be corrected in the next edition of the TEMA standards.
6/v- 3.4 (301)	1)Is it mandatory to have horizontal inlet/outlet nozzles for shell/tube side?	1) Yes

<table>
<tr><th>subject/section
(TEMA Inquiry Number)</th><th>question</th><th>reply</th></tr>
<tr><td></td><td>2) Is it mandatory to have vertical nozzles irrespective of baffle cut(horizontal or vertical) ?</td><td>2) No</td></tr>
<tr><td>6/V-8

(213)</td><td>What density (liquid or vapor) should be used to calculate delta sub 2 when the fluid is two-phase.</td><td>The liquid density should be used.</td></tr>
<tr><td>Questionnaire for FIV Span Geometry (308)</td><td>For the referenced tube spans in the following sketch, what are the correct tube geometries to use as referenced in Table V-5.3 (click on image for full-size)</td><td>For the referenced tube spans, the appropriate geometries to use as follows:
<table><tr><td>Span No.
1
2
3
4
5
6
7
8
9
10
11
12</td><td>TEMA Geometry
1
1
2
4
1
2
1
1
2
5
1
2</td></tr></table></td></tr>
<tr><td>6/ V-8

(129)</td><td>In Paragraph V-8, what value of N shall be used for bundles with multiple spans of different lengths?</td><td>For straight tube bundles, N shall be the number of spans between the tubesheets (usually one greater than the number of tube supports) for the tube analyzed. For U-tube bundles, N shall be the number of spans in the whole U-tube (considered both legs) including one for U-bend, if unsupported, or two for the U-bend if supported mid-span.</td></tr>
<tr><td>6/V-13.5 (274)</td><td>What is the best way to support a U-bend portion of a bundle for vibration?</td><td>The intent of Paragraph V-13.5 is to alert the user to consider proper support at the U-bend to prevent damage due to vibration. We can not provide advice</td></tr>
</table>

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		on the design of this support. Any method which provides lateral support of the tubes will meet the
T -4.33 (258)	Can the equations in paragraph T-4.33 be used to determine the maximum and minimum temperatures of the tubesheet?	No, the equations are only intended to calculate the mean temperature.
Table D-5M (111)	What standard is used for bolting data in Table D-5M?	The bolting data in Table D-5M is based on ASME B1.13M- 1995 metric screw threads- M profile. In RCB-11 the statement regarding 8- pitch thread series does not apply to metric threads. The bolt sizes shown are for your convenience, but do not limit the use of other metric sizes or standards.
Table D7-M	Tube OD 33.1 mm should read 38.1mm	38.1 mm is the correct value.
Section 9; Tables D-11 & D-10 (212)	Is it appropriate to approximate the values beyond those given in Tables D-10, D-10M, D-11, and D-11M?	It is appropriate to interpolate between values shown but it is not appropriate to extrapolate beyond those values.
section 9, table D-11 M (284)	Is it acceptable to use coefficients of thermal expansion taken from ASME Section 2, part D(2001 edition) in lieu of the values shown in TEMA?	The values shown in TEMA were taken from a previous edition of the ASME Code and therefore, it is acceptable to use the updated values.
Table D-11 (298)	In using Table D-11 for determining coefficients of thermal expansion, how should carbon steel SA 516-60/70 be classified?	In previous editions of the ASME Code (1995 and before), SA -516-60/70 material has been classified as C-Mn-Si steel.
RGP RCB 4.62 (249)	Is the shell entrance or exit area calculated by the formula in Paragraph RGP-RCP-4.621 and 4.622 limited to rectangular plates?	No, the above formula can be used for either circular or rectangular plates. Note that the shape of the plate is taken into consideration in Paragraph RGP-RCB-4.623 and 4.624 for calculating bundle entrance or exit areas.
RGP-RCB 4.623 & 4.624 (126)	Is the reference correct for K= Dn for Figure RGP-RCB-4.6231?	No, the reference should read K= Dn for Figure RGP-RCB-4.6241

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RGP- G -7.1124 pages 259-260 (123)	The units shown in paragraph RGP-G-7.1124 A) B) & C) for RVREFF and RVSEFF is in-lb,(mm-kN) Are these units correct as shown?	The units shown are incorrect. The correct units for RVFEFF and RVSEFF is lb, (kN)
Section 10 (314)	What fouling factor does TEMA recommend for the air side of a heat exchanger in cement plant service?	The table of fouling resistances following TEMA paragraph RGP-T-2,4 has a suggested fouling allowance for compressed air only. If this value is not sufficient for your service, designer should consult with the end user and arrive at a mutually acceptable value.