RISER INSTALLATION INSTRUCTIONS

The installation and adjustment procedure for risers varies some with the type of system being installed. There are 4 primary system types that will be addressed here.

(1) Anchored System with no secondary spring support. Note: the anchor may be fixed *(KPA)* or may be semi-fixed *(FHS, FLS, or FLSS isolator)*.

(2) Anchored System with secondary spring support. Note: the anchor may be fixed *(KPA)* or may be semi-fixed *(FHS, FLS, or FLSS isolator)*.

(3) Fully spring supported system using one or more vertically restrained isolators *(KRG-R or FRS)* in conjunction with non-vertically restrained isolators *(FDS or KRG)*.

(4) Fully spring supported system with no Anchor and using no vertically restrained isolators (FDS or KRG isolators only).

Risers may be comprised of Riser segments that are broken by discontinuities such as jogs or expansion couplings. If this is the case, each segment must be installed as a separate, independent entity. These segments are shown on the Riser schematic provided by KNC being separated by these discontinuities. Each segment also has its own detailed analysis that is linked to the schematic. While the schematic offers general input as to the components used, adjustment and anticipated movement at the ends of the segment, more detailed information as to growth or shrinkage at each floor level can be obtained from the detailed analyses.

Where made up of a series of segments, it is quite possible for the different segments to be of different types (based on the types listed above). The appropriate installation procedure for each segment should be used to ensure a proper installation.

There is no provision in the design of a Riser support system for a change of elevation of key features or discontinuities. Any changes will impact the performance of the system, sometimes in a significant fashion. If any significant feature changes between the design phase and the installation phase, KNC must be notified and the revised system must be re-modeled.

Note that significant variations in the "average" install temperature (from what was used in the analysis) will result in variations in the expected expansion/contraction amounts and isolator spring deflection set dimensions. Confirm that the nominal install temperature is within 10 degrees of that used in the analysis before proceeding.

It is also important to allow access to the riser support system for inspection and fine tuning of the isolators after the supported system is activated and brought up to temperature. Variations between the ideal conditions as used in the analysis and the actual conditions experienced in the field may lead to the need for minor adjustments at this point.

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Select from the above list, the type of system that represents the Riser segment being installed and follow the appropriate procedure below:

Type 1 (An anchored System with no secondary spring support)

1) In this type of system, the Riser pipe will grow or shrink relative to the anchor location. The schematic provided by Kinetics Noise Control indicates the amount of change in elevation that should be expected at the top and bottom of the riser segment. Provisions should be made and the baseline installed elevation of the ends of the riser must be positioned to accommodate the indicated growth or shrinkage at the ends.

2) All Riser support and guidance components are installed in sets of (2) straddling the Riser pipe (180 degrees apart and at the same elevation).

3) The vertical run of piping will eventually be supported entirely by the Anchors. If the Anchors are at the base, they can be installed immediately and the Riser segment be built upward from it. If the Anchors are at some higher elevation, the vertical run of piping should be temporarily supported until the Anchors are placed and firmly attached to the Riser segment.

4) The Riser pipe must be connected to the Anchors in a positive fashion. This is often accomplished through the use of a heavy duty riser clamp, but for extremely high loads, some type of a welded saddle is recommended. The peak vertical loads that the connection must be able to withstand are listed in the detailed analysis document for that segment as the loads present at the anchor location. Note that there may be a significant difference in the load magnitude between the initial and installed condition. The connection must be able to resist both.

5) For Seismically rated applications, the Anchors must be attached to the structure using the appropriate welds, A307 bolts or seismically rated anchors.

6) Guides are also typically attached to the riser using heavy duty riser clamps. These guides should be located as per the documentation provided by KNC. Where interfacing with a discontinuity such as expansion couplings, expansion loops or at the top or bottom of the overall Riser system, these guides should be placed as closely to the discontinuity as possible while still being on the same Riser segment. In some cases, it may be possible to use sleeved holes in the floor as guides. If this is being done, the holes should be packed with some type of resilient material that will prevent any more than ¼" lateral motion of the Riser pipe while still allowing it to grow or shrink freely.

7) Guides should be adjusted during installation so that the nominal center of their travel is aligned at an elevation of the pipe that reflects a midway position between the installed and operating condition.

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8) For Seismically rated applications, the Guides must be attached to the structure using the appropriate welds, A307 bolts or seismically rated anchors.

9) Any piping that interfaces with the Riser segment on intermediate levels must be installed in such a fashion as to allow the Riser pipe to grow or shrink as expected at that elevation. The relative motion expected at all elevations is listed on the detailed Riser segment Analysis document as a change in elevation value.

10) When installing expansion couplings or loops at the ends of a Riser segment, these must be installed so that their allowance for growth or shrinkage is coincident with the expected growth or shrinkage of the Riser segment. (ie: If the Riser is expected to expand, the coupling will need to collapse – it must be installed so it can collapse.) Also confirm that any tie straps or motion limiting components that may have been fitted on expansion joints have been removed prior to activating the system.

Type 2 (An anchored System with secondary spring support)

1)In this type of system, the Riser pipe will grow or shrink relative to the anchor location. The schematic provided by Kinetics Noise Control indicates the amount of change in elevation that should be expected at the top and bottom of the riser segment. Provisions should be made and the baseline installed elevation of the ends of the riser must be positioned to accommodate the indicated growth or shrinkage at the ends.

2) All Riser support and guidance components are installed in sets of (2) straddling the Riser pipe (180 degrees apart and at the same elevation).

3) The vertical run of piping will eventually be located and aligned with the Anchors. If the Anchors are at the base, they can be installed immediately and the Riser segment be built upward from it. If the Anchors are at some higher elevation, the vertical run of piping should be temporarily supported until the Anchors are placed and firmly attached to the Riser segment.

4) If the Riser segment is fitted with restrained spring isolators, it is possible to pre-compress the springs to the desired installed deflection prior to attaching them to the Riser pipe. Where restrained spring isolators are not used (or not possible to use), the installed deflection must be set after the isolators are firmly connected to the Riser pipe and the Riser pipe is firmly anchored in place.

5) The Riser pipe must be connected to the Anchors and to any support Isolators in a positive fashion. This is often accomplished through the use of a heavy duty riser clamp, but for extremely high loads, some type of a welded saddle is recommended. The peak vertical loads that the connection must be able to withstand are listed in the detailed analysis document for that segment as the loads present at the anchor location. Note that there may

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be a significant difference in both the load magnitude and direction between the initial and installed condition. The connection must be able to resist both.

6) For Seismically rated applications, the Anchors must be attached to the structure using the appropriate welds, A307 bolts or seismically rated anchors. Unless the Isolators also act as guides, they do not require Seismically rated anchors.

7) Guides are also typically attached to the riser using heavy duty riser clamps. These guides should be located as per the documentation provided by KNC. Where interfacing with a discontinuity such as expansion couplings, expansion loops or at the top or bottom of the overall Riser system, these guides should be placed as closely to the discontinuity as possible while still being on the same Riser segment. In some cases, it may be possible to use sleeved holes in the floor as guides. If this is being done, the holes should be packed with some type of resilient material that will prevent any more than ¼" lateral motion of the Riser pipe while still allowing it to grow or shrink freely.

8) Guides should be adjusted during installation so that the nominal center of their travel is aligned at an elevation of the pipe that reflects a midway position between the installed and operating condition.

9)Any piping that interfaces with the Riser segment on intermediate levels must be installed in such a fashion as to allow the Riser pipe to grow or shrink as expected at that elevation. The relative motion expected at all elevations is listed on the detailed Riser segment Analysis document as either a change in elevation value (if no isolator is fitted at that location) or as an operating spring deflection (which can be compared to the initial spring deflection to evaluate the elevation change) where an isolator is present.

10) When installing expansion couplings or loops at the ends of a Riser segment, these must be installed so that their allowance for growth or shrinkage is coincident with the expected growth or shrinkage of the Riser segment. (ie: If the Riser is expected to expand, the coupling will need to collapse – it must be installed so it can collapse.) Also confirm that any tie straps or motion limiting components that may have been fitted on expansion joints have been removed prior to activating the system.

Type 3 (Fully spring supported system using one or more vertically restrained isolators)

1) In this type of system, the Riser pipe will grow or shrink relative to a relatively nebulous point that is the centroid of the total combined spring support anchor location. The schematic provided by Kinetics Noise Control indicates the amount of change in elevation that should be expected at the top and bottom of the riser segment. Provisions should be made and the baseline installed elevation of the ends of the riser must be positioned to accommodate the indicated growth or shrinkage at the ends.

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2) All Riser support and guidance components are installed in sets of (2) straddling the Riser pipe (180 degrees apart and at the same elevation).

3) The vertical run of piping will eventually be located and aligned with one or more of the vertically restrained isolators. If these are at the base, they can be installed immediately and the Riser segment be built upward from it. If at some higher elevation, the vertical run of piping should be temporarily supported until the vertically restrained are placed and firmly attached to the Riser segment.

4) Since the Riser segment is fitted with restrained spring isolators, it is possible to pre-compress the springs at these locations to the desired installed deflection prior to attaching them to the Riser pipe. Where restrained spring isolators are not used (or not possible to use), the installed deflection must be set after the isolators are firmly connected to the Riser pipe and the Riser pipe is firmly locked in place by those isolators that are vertically restrained.

5) The Riser pipe must be connected to all support Isolators in a positive fashion. This is often accomplished through the use of a heavy duty riser clamp, but for extremely high loads, some type of a welded saddle is recommended. The peak vertical loads that the various connections must be able to withstand are listed in the detailed analysis document. Note that there may be a significant difference in both the load magnitude and direction between the initial and installed condition. The connection must be able to resist both.

6) For Seismically rated applications, the all guides must be attached to the structure using the appropriate welds, A307 bolts or seismically rated anchors.

7) Guides are also typically attached to the riser using heavy duty riser clamps. These guides should be located as per the documentation provided by KNC. Where interfacing with a discontinuity such as expansion couplings, expansion loops or at the top or bottom of the overall Riser system, these guides should be placed as closely to the discontinuity as possible while still being on the same Riser segment. In some cases, it may be possible to use sleeved holes in the floor as guides. If this is being done, the holes should be packed with some type of resilient material that will prevent any more than ¼" lateral motion of the Riser pipe while still allowing it to grow or shrink freely.

8) Guides should be adjusted during installation so that the nominal center of their travel is aligned at an elevation of the pipe that reflects a midway position between the installed and operating condition.

9) Any piping that interfaces with the Riser segment on intermediate levels must be installed in such a fashion as to allow the Riser pipe to grow or shrink as expected at that elevation. The relative motion expected at all elevations is listed on the detailed Riser segment Analysis document as either a change in elevation value (if no isolator is fitted at that location) or as

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an operating spring deflection (which can be compared to the initial spring deflection to evaluate the elevation change) where an isolator is present.

10) When installing expansion couplings or loops at the ends of a Riser segment, these must be installed so that their allowance for growth or shrinkage is coincident with the expected growth or shrinkage of the Riser segment. (ie: If the Riser is expected to expand, the coupling will need to collapse – it must be installed so it can collapse.) Also confirm that any tie straps or motion limiting components that may have been fitted on expansion joints have been removed prior to activating the system.

Type 4 (Fully spring supported system with no Anchor and using no vertically restrained isolators)

1) This type of system should be used only when there is no significant change in weight expected in the riser between the installed and operating condition. A steam line might be an example of this.

2) In this type of system, the Riser pipe will grow or shrink relative to a relatively nebulous point that is the centroid of the total combined spring support anchor location. The schematic provided by Kinetics Noise Control indicates the amount of change in elevation that should be expected at the top and bottom of the riser segment. Provisions should be made and the baseline installed elevation of the ends of the riser must be positioned to accommodate the indicated growth or shrinkage at the ends.

3) All Riser support and guidance components are installed in sets of (2) straddling the Riser pipe (180 degrees apart and at the same elevation).

4) The vertical run of piping is free floating in this case and will need to be temporarily blocked to an installation elevation. On the detailed analysis, an elevation will be identified in the tabulated data where there will be no anticipated difference between the installed and operating condition. It is this point that should be used as a reference when temporarily blocking the piping in place during installation. The riser will expand or contract relative to this location in service.

5) Since the Riser segment is not restrained, it is not possible to pre-compress the springs at these locations to a desired installed deflection prior to attaching them to the Riser pipe. Instead, the installed deflection must be set after the isolators are firmly connected to the Riser pipe and the Riser pipe is firmly locked in place by the temporary blocking.

6) The Riser pipe must be connected to all support Isolators in a positive fashion. This is often accomplished through the use of a heavy duty riser clamp, but for extremely high loads, some type of a welded saddle is recommended. The peak vertical loads that the various connections must be able to withstand are listed in the detailed analysis document. There

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will be some differences in the loads between the initial and installed condition. The connection must be able to resist both.

7) For Seismically rated applications, the all guides must be attached to the structure using the appropriate welds, A307 bolts or seismically rated anchors.

8) Guides are also typically attached to the riser using heavy duty riser clamps. These guides should be located as per the documentation provided by KNC. Where interfacing with a discontinuity such as expansion couplings, expansion loops or at the top or bottom of the overall Riser system, these guides should be placed as closely to the discontinuity as possible while still being on the same Riser segment. In some cases, it may be possible to use sleeved holes in the floor as guides. If this is being done, the holes should be packed with some type of resilient material that will prevent any more than ¼" lateral motion of the Riser pipe while still allowing it to grow or shrink freely.

9) Guides should be adjusted during installation so that the nominal center of their travel is aligned at an elevation of the pipe that reflects a midway position between the installed and operating condition.

10) Any piping that interfaces with the Riser segment on intermediate levels must be installed in such a fashion as to allow the Riser pipe to grow or shrink as expected at that elevation. The relative motion expected at all elevations is listed on the detailed Riser segment Analysis document as either a change in elevation value (if no isolator is fitted at that location) or as an operating spring deflection (which can be compared to the initial spring deflection to evaluate the elevation change) where an isolator is present.

11) When installing expansion couplings or loops at the ends of a Riser segment, these must be installed so that their allowance for growth or shrinkage is coincident with the expected growth or shrinkage of the Riser segment. (ie: If the Riser is expected to expand, the coupling will need to collapse – it must be installed so it can collapse.) Also confirm that any tie straps or motion limiting components that may have been fitted on expansion joints have been removed prior to activating the system.

12) On completion of the installation, the temporary blocking should be removed.

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