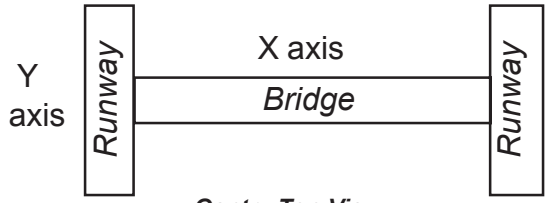
Overhead Precision Gantry Series

Motion System Description

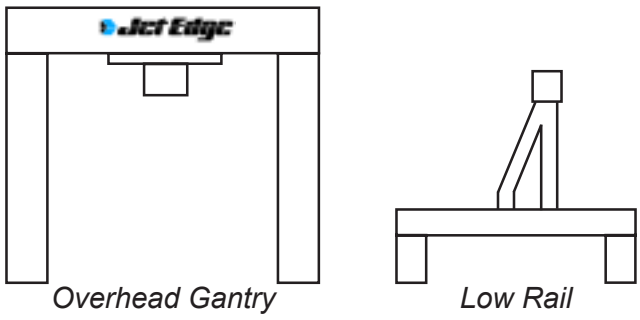
1.0 Precision Overhead Gantry Design

The Jet Edge motion system shown on the cover of this document consists of an overhead gantry structure with raised runways. A moving bridge spans between the runways. The movement of the bridge along the runway is called the Y motion. A carriage, which the cutting head is fixed to, is mounted on the bridge. The movement of the carriage along the bridge is called the X motion.



Gantry Top View

The overhead gantry design is a more stable design naturally because it hangs with gravity to hold the bridge in its normal position. A low rail gantry naturally fights gravity to stay up.



Motion Systems - Sideview

Because of the moment arm nature of the low rail style, it tends to tip a few thousandths during any type of acceleration and deceleration which dramatically affects tolerances even more at the cutting head. Jet Edge builds a more stable system that will naturally hold tighter tolerances.

This gantry configuration has an elevated runway structure. This allows better access to the work envelope and raises the critical components of the system out of the local process environment.

1.1 Bridge and Runway Construction

The system legs are 7” x 7” x 3/8” steel tubes that are secured to the foundation and provide leveling adjustment of the runway beams at the bottom of the legs. Runways are constructed of 8” x 12” x 3/8” wall rectangular steel tubes which have 1 1/4” x 2” steel ribs welded to the length of the runway. The 1 1/4” rib provides additional stiffness and is chalkfasted to provide a flat mounting surface. Chalkfast is a self-leveling compound that levels within ±.0002”. This face now provides the most accurate surface in the industry for the linear rails and ballscrews. The bridge is 7 1/2” x 11” x 1/4” wall construction. A honeycomb stucture is welded inside the beam for additional rigidity with a 1/2”steel plate welded on to cap the channel into a tube. This allows the bridge to be built lighter in weight making it more responsive to the servo motors, thus improving accuracy. Runway beams incorporate this honeycomb structure as well, when spanning over 72” of travel.

Honeycomb structure in runways and bridge

The bridge is suspended from the under side of the runways on carriage risers. These risers attach the bridge to the bearing blocks on the linear ways of the runway.

Carriage Risers attach bridge to bearing blocks

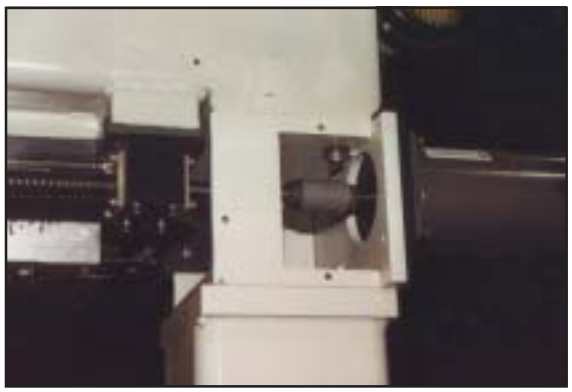
Both bridge and runway beams are stress relieved following fabrication, prior to machining. This eliminates beam flexure due to internal stresses when loads are applied.

1.2 Linear Rails and Drive System

Jet Edge uses THK linear rails in all motion systems. Each runway uses one linear rail for guidance. The high precision preloaded linear rail bearing blocks have a grease zerk to make maintenance quick and easy. Both sides feature a pre-loaded double-nut ball screw which eliminates backlash in each direction.

Preloaded Double-nut ballscrew

Directly coupled servo motors further enhance the motion systems accuracies by eliminating reversal error. Belt driven systems can encounter belt stretch or slippage which routinely leads to belt replacement.

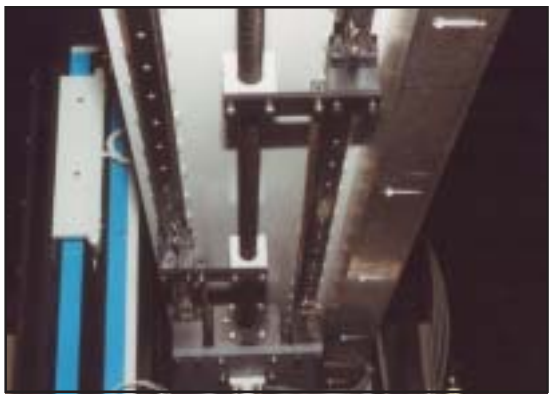


Directly coupled servo on Runways

Directly coupled servo on Bridge

The drive assemblies of all linear axes are driven by high torque servo motors. These drive mechanism designs ensure maximum speed and power efficiency under high loads, while maintaining backlash control throughout travel, contributing to the precise position accuracy and repeatability of the motion system. With high efficiency drives, natural resonance bandwidths are negligible, and induced vibrations are eliminated, which translates to smooth machine motion at the work piece.

The bridge assembly is able to maintain the tightest tolerances in the industry because three linear rails are used on the beam. Two are fastened on the bottom and one is fastened on the top.



Two rails fastened on bottom with ballscrew

One rail fastened on top

This allows travel straightness of ±0.001” over the entire travel length of the bridge at the nozzle. Again, precision machined surfaces are used to achieve the most accurate travel. Other manufactures will mount linear rails on the front of the beam. With only two datum points for straightness control, shimming is required, thus decreasing the integrity of the beam and linear motion.

In order to eliminate any type of whipping action of the ball screws, Jet Edge uses industry exclusive lead screw stabilizer blocks every 4' to support the ball screw.

Industry exclusive lead screw stabilizer blocks

Finally, Jet Edge finishes the system with a rigid 1" 6061 T6 faceplate. The Z axis utilizes a 12" travel that can be programmable. The face-plate houses the cutting heads, secondary hoppers, plumbing, and solenoids. The Z axis uses a single ball screw with two 1 1/2" diameter guides. This standard setup allows the use of mulitple heads and spreader bar as an easy add-on at a later date. Industry exclusive "Sub-Z axis" give multiple heads 3" of independent travel.

1.3 System Protection

All critical areas of the system are protected by brushes, labyrinth passages, neoprene lip seals, high volume low pressure filtered air, and metal enclosures.

High Volume, Low Pressure enclosures keep critical areas free of floating dust and particles

Labyrinth lip seals and brush design

Metal enclosures last the life of the machine. Abrasive material will wear through bellow enclosures which will cause contamination to critcal areas. Wire supports are used under the metal enclosures to secure and protect all wires thus eliminating any electrical shortage concerns.

Electrical wire supports secure wires

1.4 Scissor Arm

Jet Edge delivers UHP water to our cutting heads with a 3/8" or larger UHP tubing which is mounted on a scissor arm.

Scissor style UHP plumbing (yellow assembly)

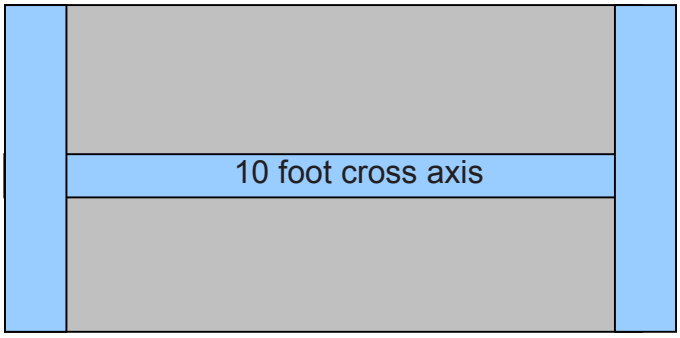
The abrasive feed line and air lines are run along the scissor arm to keep them from harm's way. The scissor arm also eliminates unneces-sary torque on the cutting assembly which can be induced by the whip style plumbing. The scissor arm also allows system installation in low clearance areas.

1.5 Multiple Cutting Heads and Spreader Bar

Multiple cutting heads increase your productivity. Jet Edge has built a rigid system that can handle this feature. With the overhead gantry waterjet system, the catcher tank is extended to accommodate the spreader bar thus increasing the work envelope.

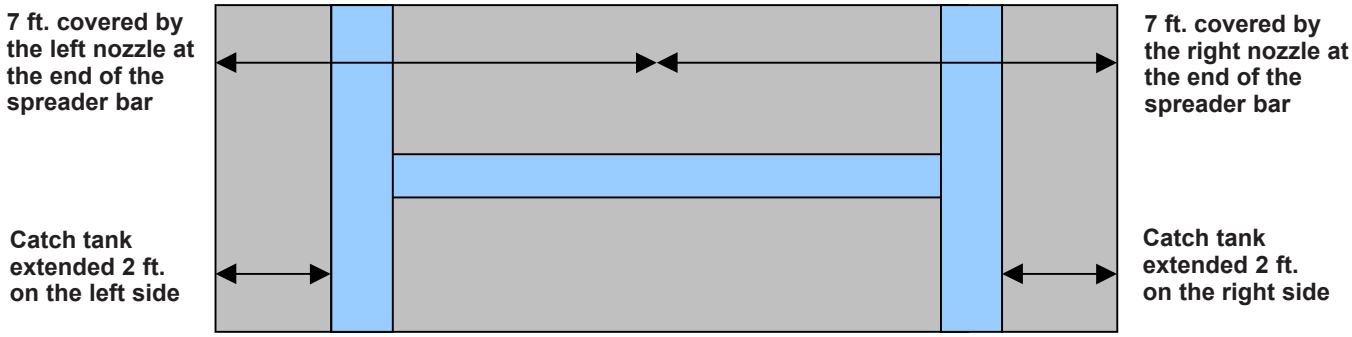
Model 610

The total cutting area of the Model 610 is 6’ by 10’ with one head as shown below.



The spreader bar is available in lengths of 36”, 48”, 60”, 72”, 90”, and 96”. Spreader bars are limited to four cutting heads, however, unique combinations will be reviewed by engineering. The intensifier pump size is determined by the volume of water needed to support the cutting heads.

Model 610 with extended catcher set up for a 4’ spreader bar



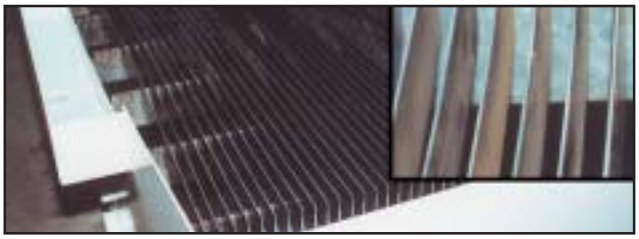
Abrasive waterjet cutting .25” brass four parts at a time

Multiple Heads Increase Productivity

Abrasive waterjet cutting .030” ceramic coated .125” steel

1.6 Catcher Tank

All Jet Edge precision gantries isolate the catcher tank from the motion system thereby eliminating any vibration in either component allowing maximum part quality. The abrasive catcher tank comes standard with replaceable slat grating. The slat is 1/8” wide and 3” deep so it lasts for long periods of time.



Replaceable grating minimizes maintenance costs

The slats are placed so they have a small arc. This prevents the waterjet from cutting into the slat when it is cutting a straight line which prevents excessive wear. Each slat can be replaced individually minimizing replacement costs.

1.7 Tolerances

Jet Edge measures system tolerances to the most stringent degree of accuracy. Renishaw Ballbar tests verify each system’s tolerances in many different aspects. The ballbar collects data dynamically from a 100mm to 600mm radius circle recording thousands of data points of reference at the cutting head. The information is then compiled which generates a total circularity in ANSI or ISO data points. Typically, this value is cut in half for a “+/-” tolerance accuracy.

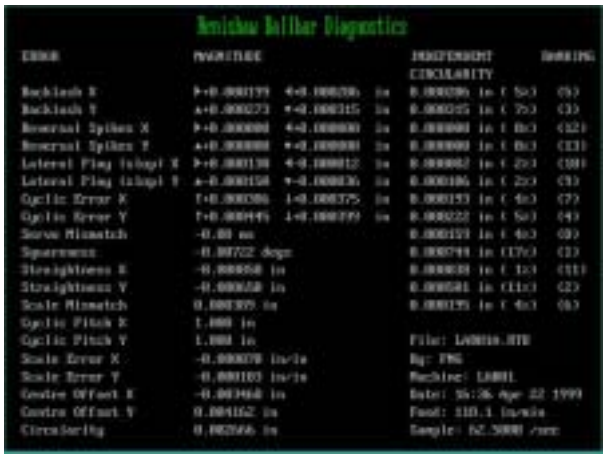


Chart form displays values

Renishaw Ballbar Diagnostics Graphic Display

Graphic representation shows where the errors lie which allow Jet Edge technicians to fine tune tables. In this example, the table positioned 0.00266” circularity or ±0.0013”. These tolerances prove that Jet Edge builds the best waterjet motion control system in the industry.

1.8 System Sizing

Jet Edge offers a variety of models to fit your cutting needs. Systems start at 4’ x 4’and increase in 2’ increments in each direction up to a 16’ x 16’. Common sizes are 4’x 8’, 6’x 10’, and 8’x 12’. Keep in mind that spreader bars can increase your work envelope allowing you to work with larger sheets for multiple head cutting.

1.9 System Options

- Multiple cutting head configurations
- Sub-Z axes
- Increase cross beam or side rail length at any time
- Abrasivejet nozzle flood
- CNC Z-axis
- Abrasive removal system
- Abrasive recycling system
- Self cleaning catcher
- Contouring speeds up to 1000 ipm
- Submergible cutting surface

2.0 Contact Information

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