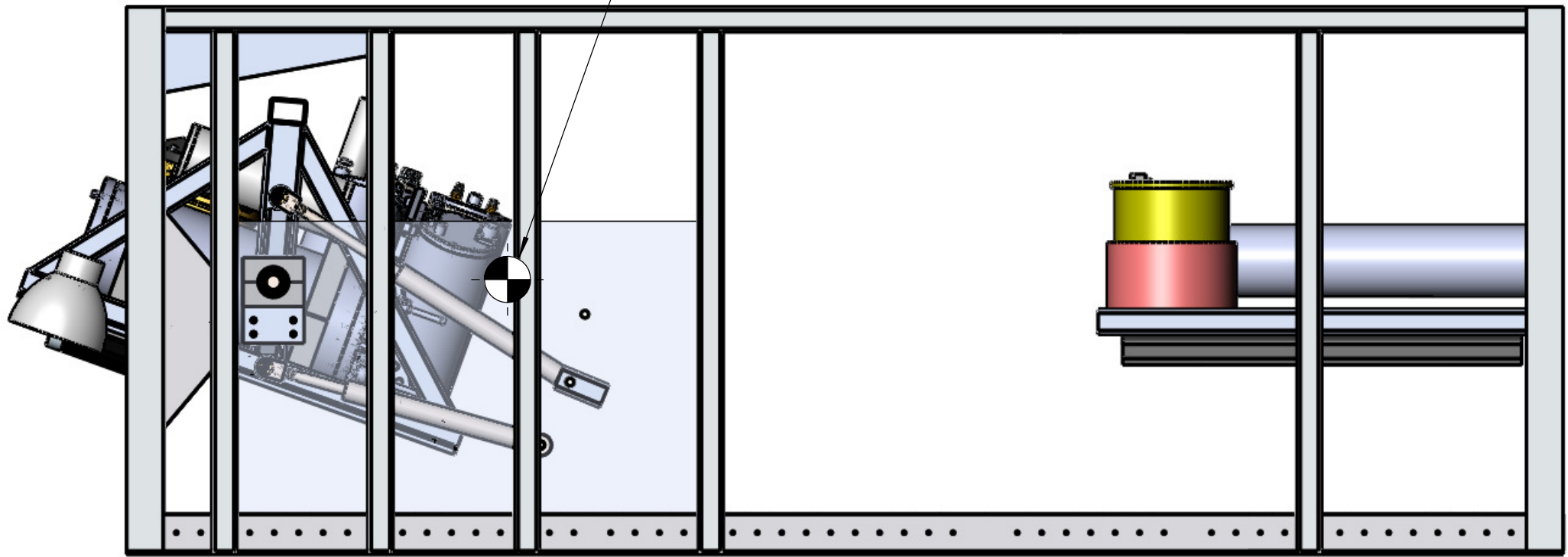
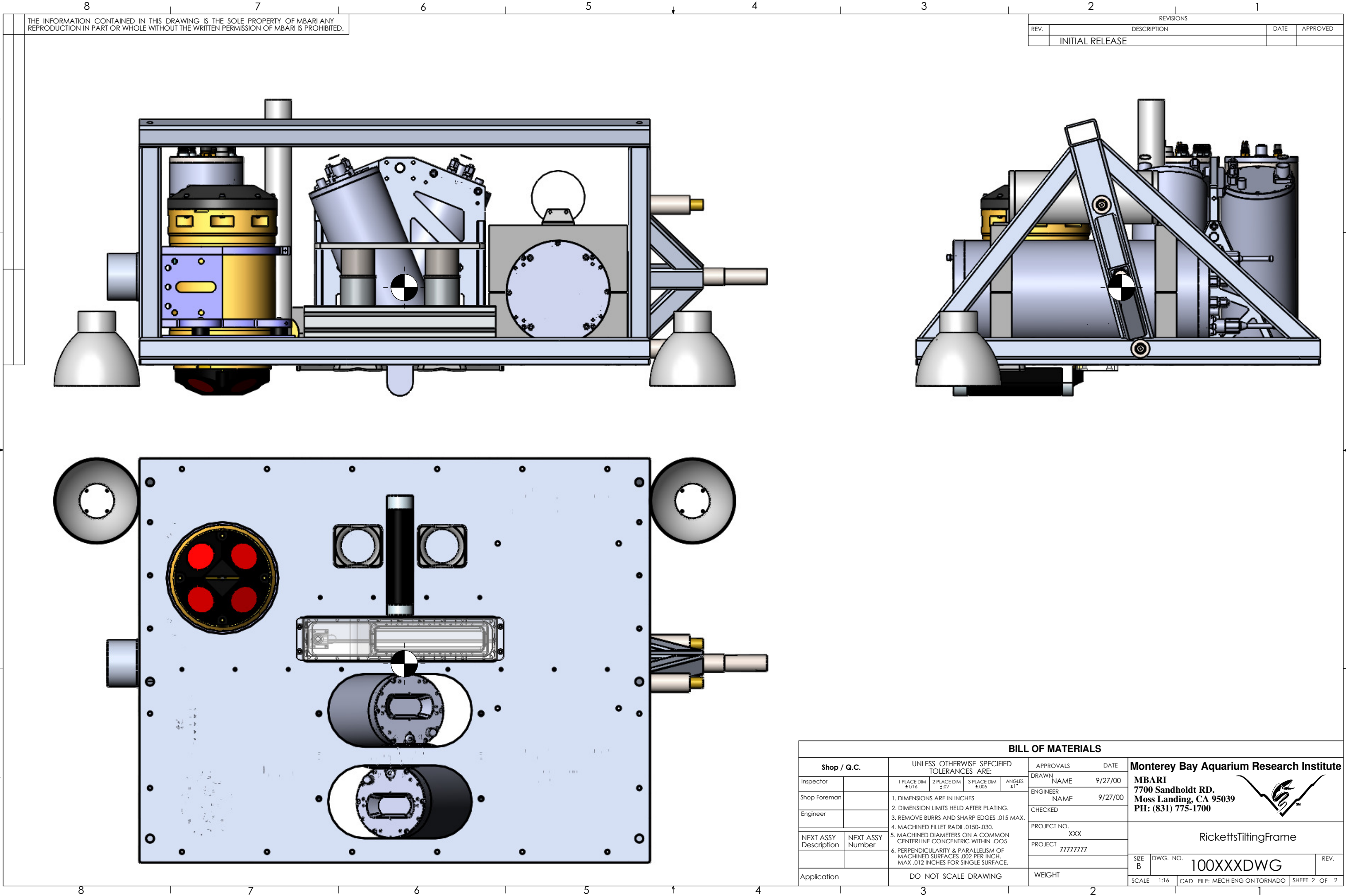


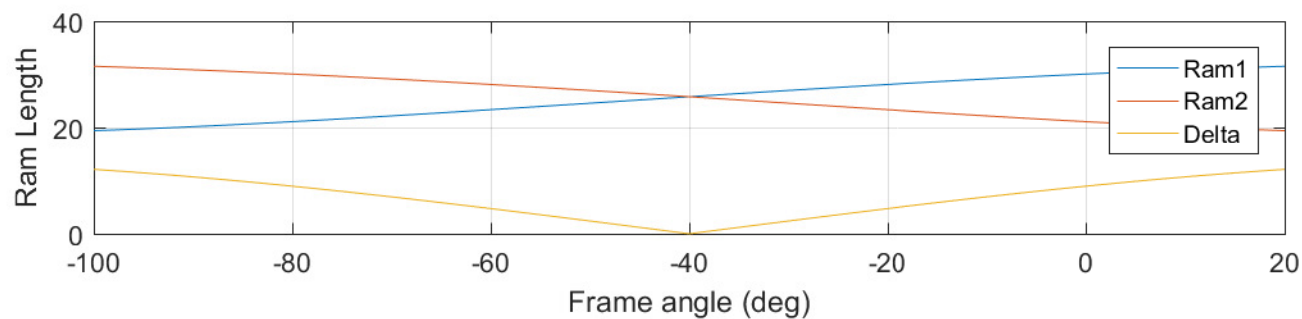
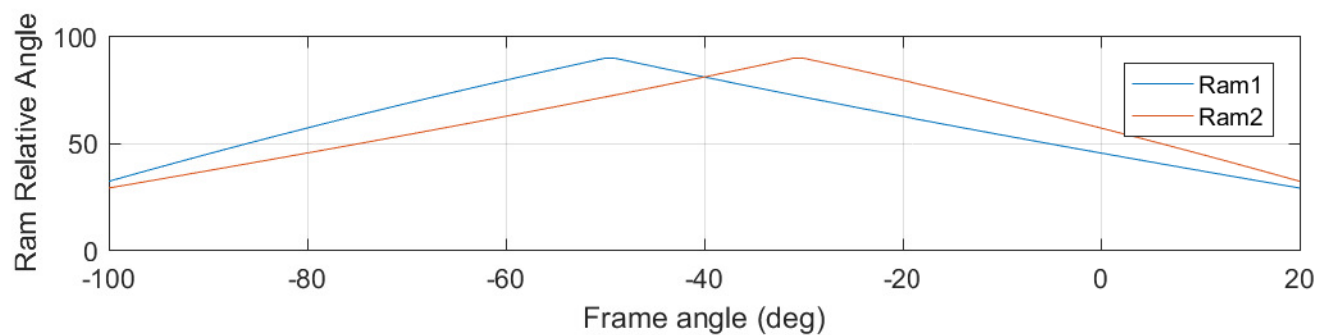
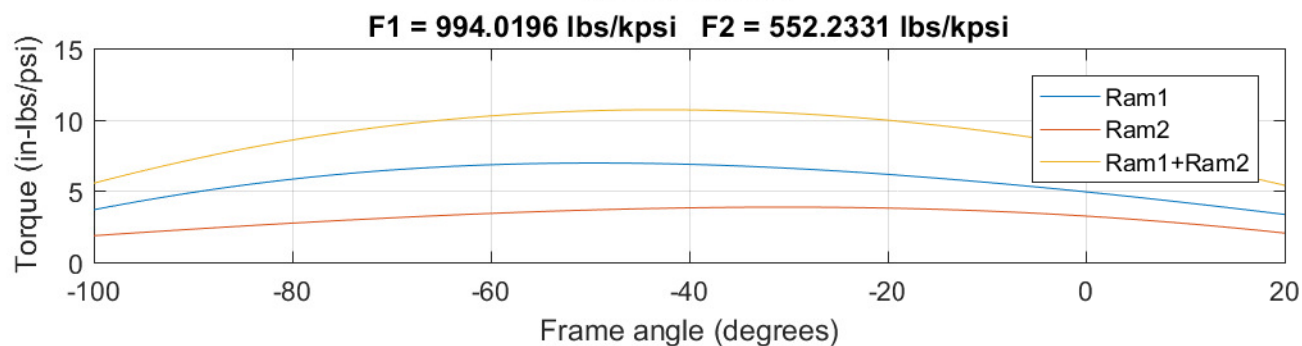
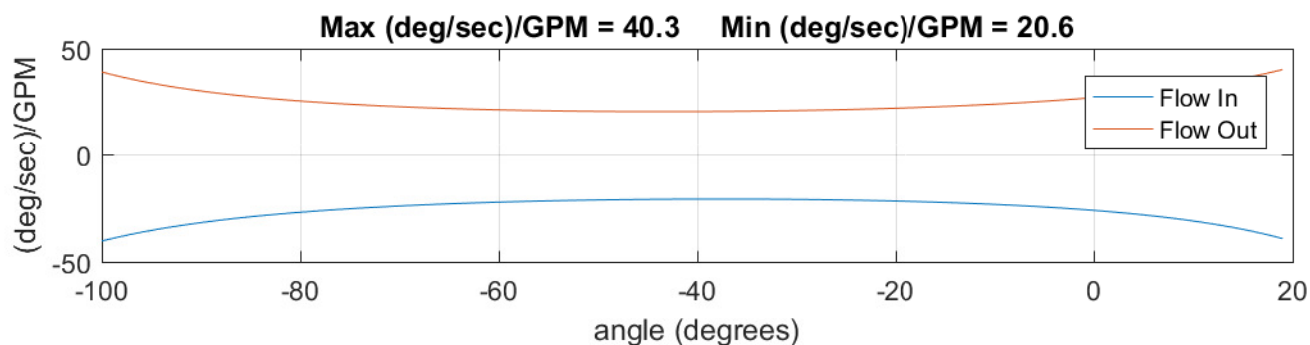
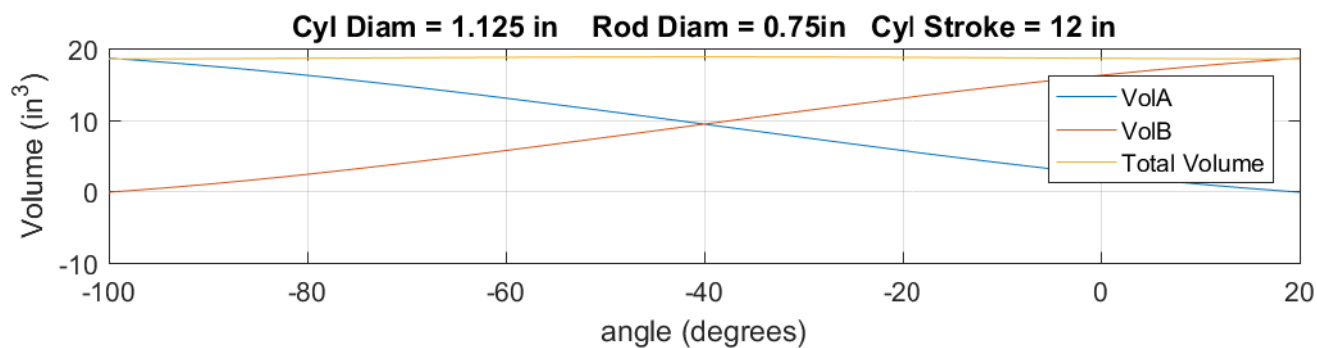
| REVISIONS |                 |      |          |
|-----------|-----------------|------|----------|
| REV.      | DESCRIPTION     | DATE | APPROVED |
|           | INITIAL RELEASE |      |          |

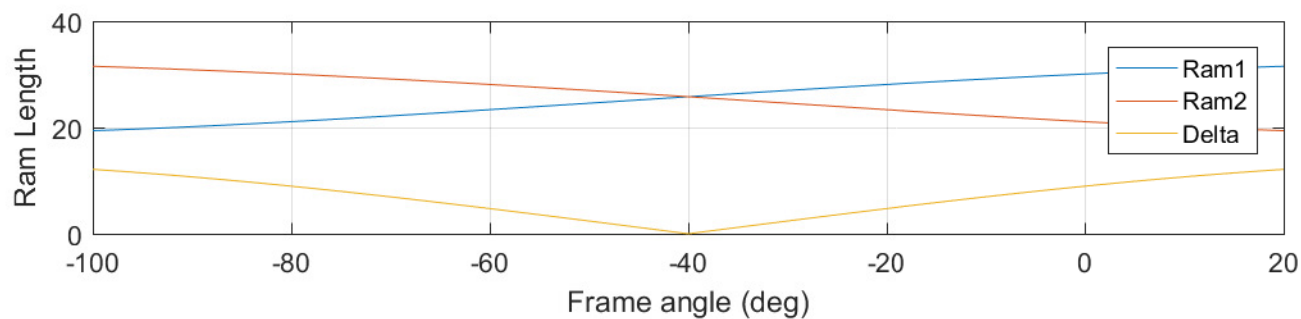
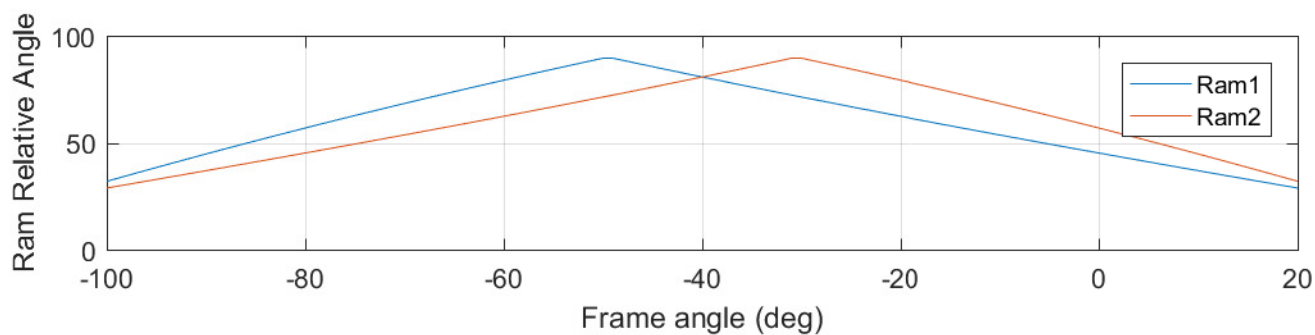
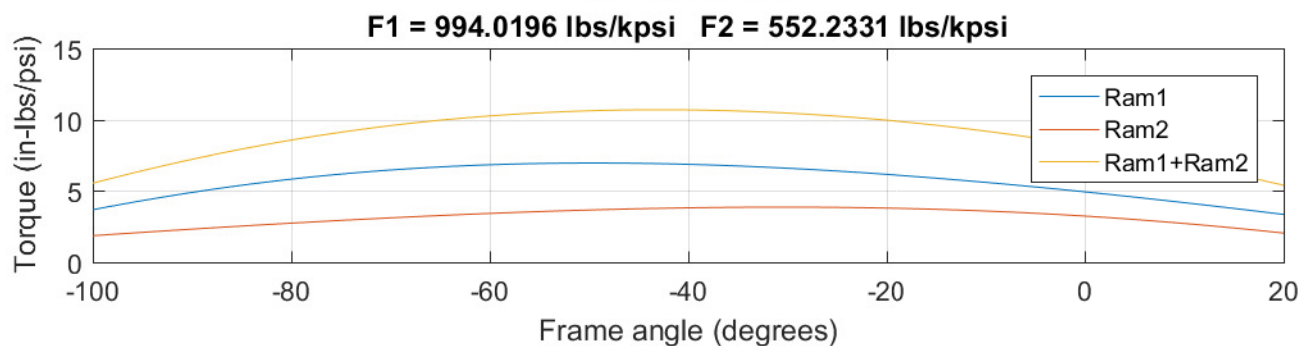
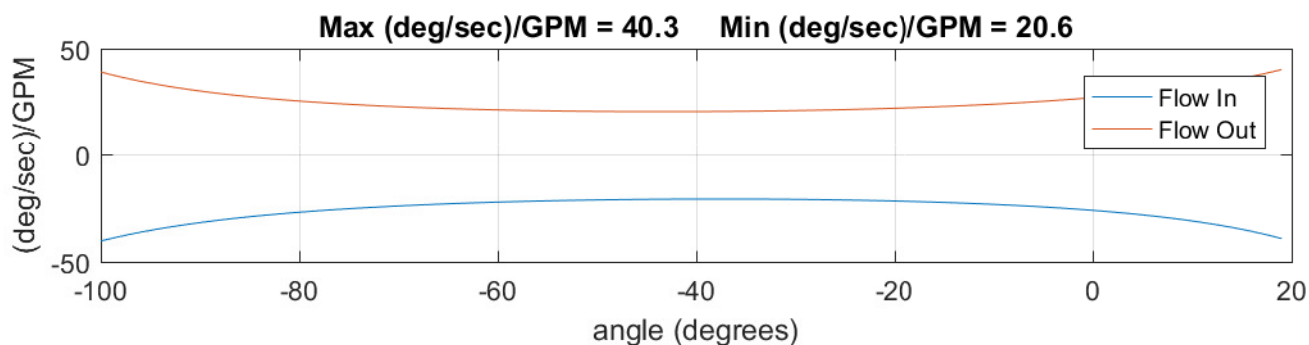
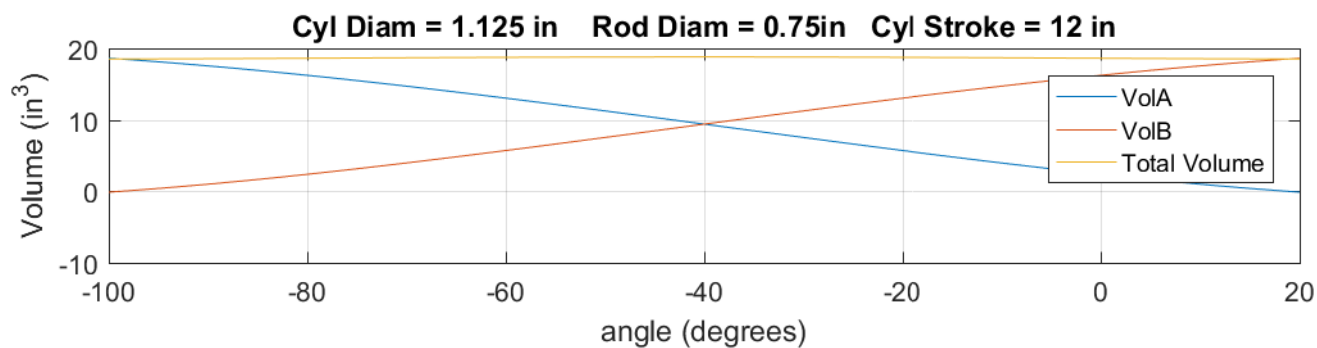
|                               | Air Weight | Wet Weight |
|-------------------------------|------------|------------|
| Sled Frame                    | 227 lbs    | 141 lbs    |
| Tilting Frame And Instruments | 673 lbs    | 387 lbs    |
| Mounts And Actuation          | 74 lbs     | 49 lbs     |
| EdgeTech Assembly             | 139 lbs    | 62 lbs     |
| Total                         | 1113 lbs   | 641 lbs    |



| BILL OF MATERIALS     |                  |                                                                                                                                                                                                                                                                                                                                                 |                     |                      |               |             |      |            |  |                                                                                                                                                                                                                                                                     |  |              |
|-----------------------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------------|---------------|-------------|------|------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--------------|
| Shop / Q.C.           |                  | UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:                                                                                                                                                                                                                                                                                                      |                     |                      |               | APPROVALS   |      | DATE       |  | <div>Monterey Bay Aquarium Research Institute</div> <div>MBARI</div> <div>7700 Sandholdt RD.</div> <div>Moss Landing, CA 95039</div> <div>PH: (831) 775-1700</div> <div></div> |  |              |
| Inspector             |                  | 1 PLACE DIM<br>±1/16                                                                                                                                                                                                                                                                                                                            | 2 PLACE DIM<br>±.02 | 3 PLACE DIM<br>±.005 | ANGLES<br>±1° | DRAWN       | NAME | 9/27/00    |  |                                                                                                                                                                                                                                                                     |  |              |
| Shop Foreman          |                  | 1. DIMENSIONS ARE IN INCHES<br>2. DIMENSION LIMITS HELD AFTER PLATING.<br>3. REMOVE BURRS AND SHARP EDGES .015 MAX.<br>4. MACHINED FILLET RADII .0150-.030.<br>5. MACHINED DIAMETERS ON A COMMON CENTERLINE CONCENTRIC WITHIN .005<br>6. PERPENDICULARITY & PARALLELISM OF MACHINED SURFACES .002 PER INCH, MAX .012 INCHES FOR SINGLE SURFACE. |                     |                      |               | ENGINEER    | NAME | 9/27/00    |  |                                                                                                                                                                                                                                                                     |  |              |
| Engineer              |                  |                                                                                                                                                                                                                                                                                                                                                 |                     |                      |               | CHECKED     |      |            |  |                                                                                                                                                                                                                                                                     |  |              |
| NEXT ASSY Description | NEXT ASSY Number |                                                                                                                                                                                                                                                                                                                                                 |                     |                      |               | PROJECT NO. |      | XXX        |  | <div>RickettsTiltingFrame</div> <div></div>                                                                                                                                    |  |              |
|                       |                  |                                                                                                                                                                                                                                                                                                                                                 |                     |                      |               | PROJECT     |      | ZZZZZZZZ   |  |                                                                                                                                                                                                                                                                     |  |              |
|                       |                  |                                                                                                                                                                                                                                                                                                                                                 |                     |                      |               |             |      |            |  |                                                                                                                                                                                                                                                                     |  |              |
| Application           |                  | DO NOT SCALE DRAWING                                                                                                                                                                                                                                                                                                                            |                     |                      |               | WEIGHT      |      | SIZE B     |  | DWG. NO. 100XXXDWG                                                                                                                                                                                                                                                  |  | REV.         |
|                       |                  |                                                                                                                                                                                                                                                                                                                                                 |                     |                      |               |             |      | SCALE 1:48 |  | CAD FILE: MECH ENG ON TORNADO                                                                                                                                                                                                                                       |  | SHEET 1 OF 2 |







# 30 SERIES MICRO SERVO VALVES

Responsive valve in a compact package



The 30 Series is a two-stage, flow control, double-nozzle, mechanical feedback servo valve that has a stainless steel body and integrated torque motor in an environmentally sealed compartment. Its nozzle-flapper design is a proven technology for applications where high response, stability and accuracy are required in a compact package.

The 30 Series Servo Valve is designed to provide a long service life even in demanding and extreme conditions. These products perform reliably in high and low temperatures, and high acceleration, shock and vibration environments. Along with the 24 and 32 Series Servo Valves, this product is part of our proven micro hydraulics offering that is well known for high power to weight ratio and efficiency, while delivering high dynamics and precise flow control for better overall system control.



*Compact, light-weight package with a high power to weight ratio*



*Micro-hydraulics are ideal for applications requiring high power density*

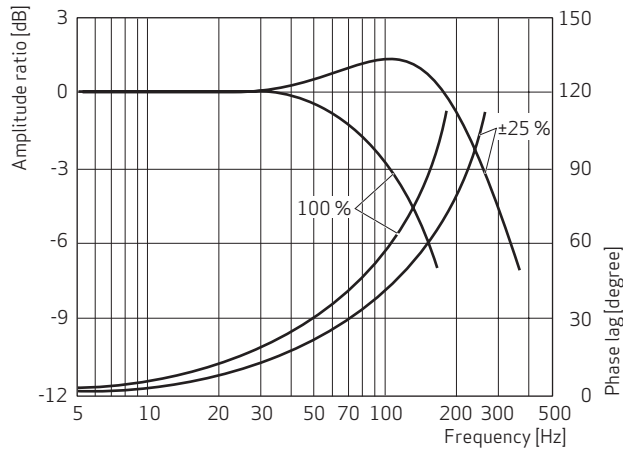
## ADVANTAGES

- High response improves control capability
- Compact light weight package for mobile applications
- Rugged construction designed for extreme conditions

## APPLICATIONS

- AGV/ROV
- Manipulators
- Downhole Tools
- Entertainment
- Robotics for Unstructured Environments
- Human-Scale Robotics
- Mobile Robotics including Construction
- Collaborative Robotics
- Quadrupeds
- Humanoid
- Biomimetic
- Exo-Skeletons
- Haptics
- Virtual Reality, Simulation and Training
- Autonomous Vehicles

## RESPONSE PLOT

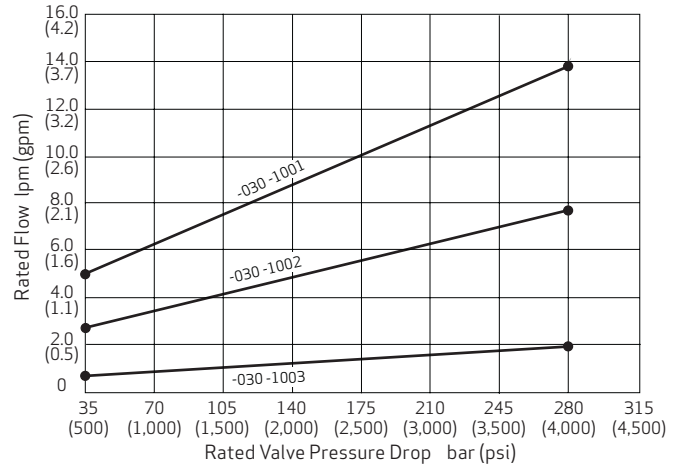


Typical Responses for Peak Sinusoidal Inputs of  $\pm 25\%$  and  $\pm 100\%$  Rated Current

Supply 210 bar (3,000 psi)

Oil Temp 38°C (100°F)

## PERFORMANCE CURVE



## DYNAMIC TECHNICAL SPECIFICATIONS

|                                       |            |
|---------------------------------------|------------|
| Frequency of 90 deg phase (3,000 psi) | < 2 dB     |
| Step Response                         | 2.5 ms     |
| Amplitude Ratio                       | > 200 Hz   |
| First Order Time Constant             | 0.0015 sec |
| 2nd Order Natural Frequency           | 200 Hz     |
| Damping Ratio                         | 0.50       |

## GENERAL TECHNICAL SPECIFICATIONS

|                                    |                                                                       |
|------------------------------------|-----------------------------------------------------------------------|
| Weight                             | 185 g (6.5 oz)                                                        |
| Maximum Operating Pressure         | 310 bar (4,500 psi)                                                   |
| Rated Flow                         | 0.47 to 6.9 l/min (0.125 to 1.85 gpm) @ $\Delta p$ 70 bar (1,000 psi) |
| Mounting Pattern                   | 0.48 in. port circle [ISO 10372-01-01-0-92]                           |
| <b>Static Performance</b>          |                                                                       |
| Rated Flow Tolerance               | $\pm 10\%$                                                            |
| Linearity                          | $< \pm 7\%$                                                           |
| Null Region                        | $< \pm 3\%$                                                           |
| Null Bias                          | $< \pm 3\%$ initial; $< \pm 5\%$ long term                            |
| Hysteresis                         | $< \pm 3\%$                                                           |
| Threshold                          | $< \pm 1\%$                                                           |
| Operating Temperature              | -20°F to 400°F (-28°C to 204°C)                                       |
| Internal Leakage @ 3,000 psi (cis) | $< \pm 3\%$ rated flow plus $< 0.50$ cis tare                         |
| Proof Pressure                     | 415 bar (6,000 psi) max (Supply), 275 bar (4,000 psi) (Return)        |
| Burst Pressure                     | 690 bar (10,000 psi) max (Supply), 345 bar (5,000 psi) (Return)       |
| Shock Resistance                   | Will withstand 100g peak any axis                                     |
| Vibration Resistance               | Will withstand 25grms (5 to 2,000 Hz) 30 minutes per axis             |

G77X/77X SERIES SERVO VALVES -STANDARD RESPONSE SERVO VALVES

