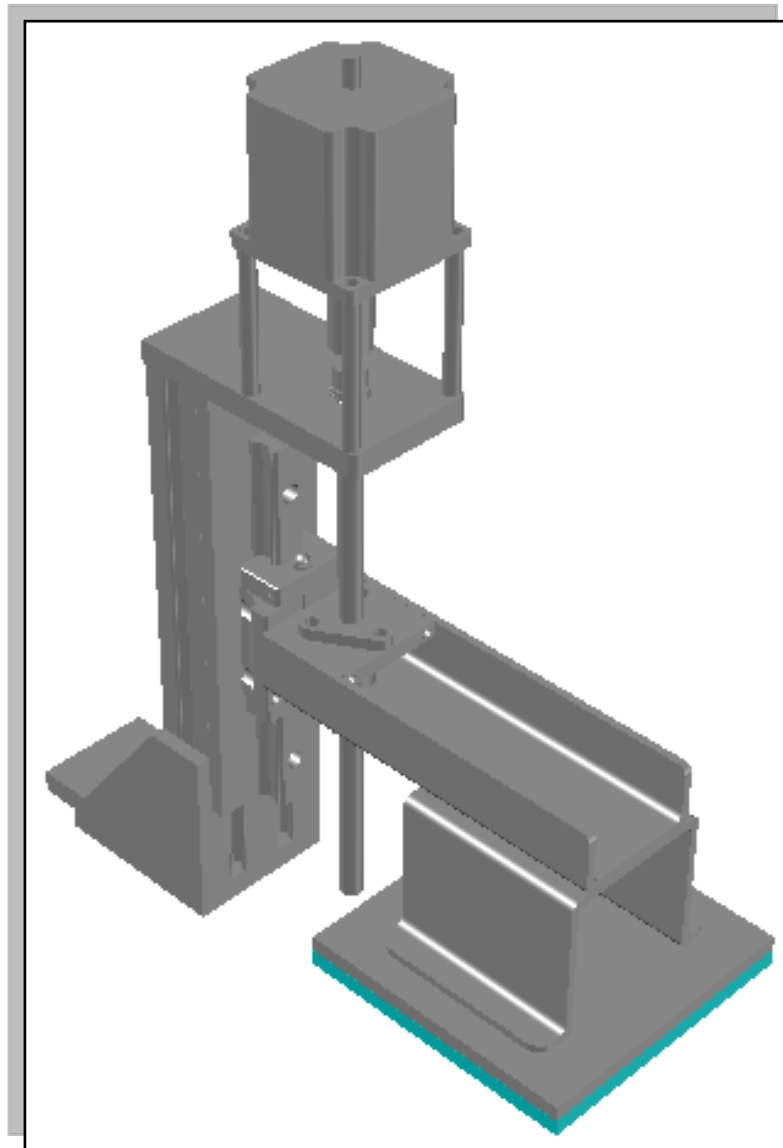


Build Platform Assembly

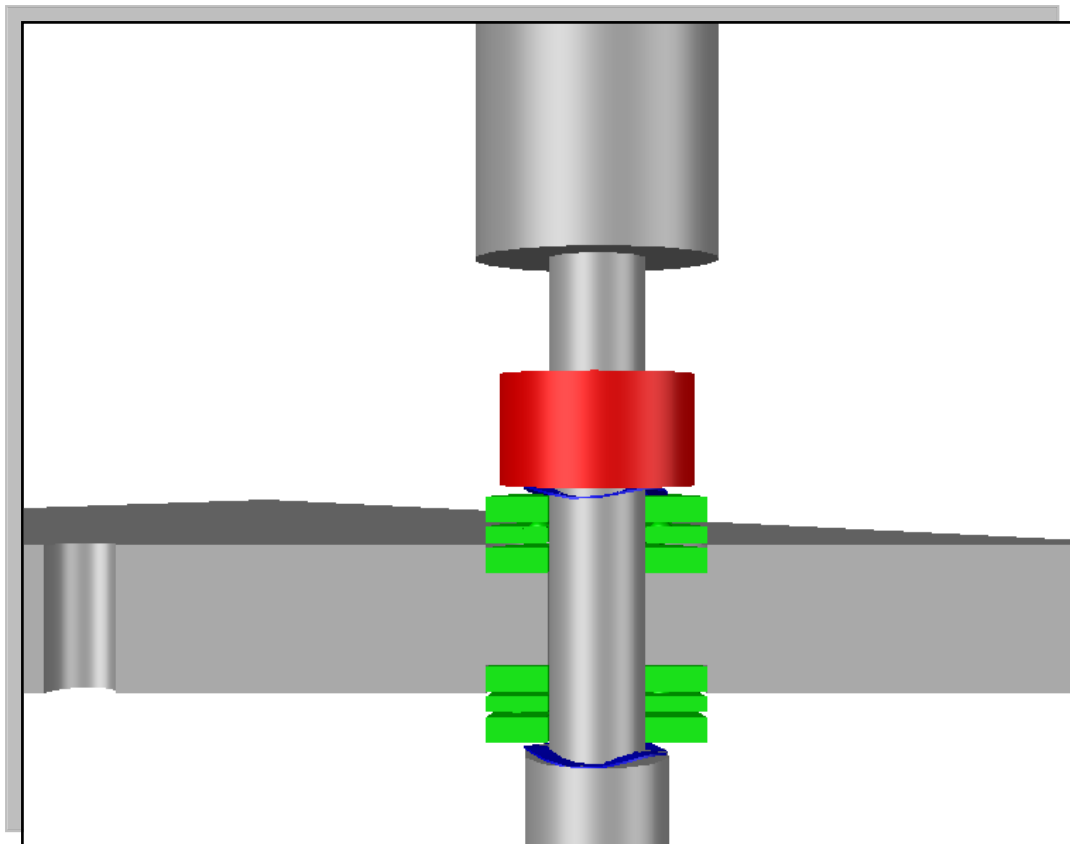
Linear motion in the z-axis for the build platform is achieved through the use of a Linear Cage Ball Guide, SHS15C1UU+160L. This linear guide features unique contact angles allowing high loading in any orientation and was chosen mainly because of this feature. Movement in the z-axis is created by a 3/8-10 modified ACME lead screw with an anti-backlash nut that removes any need to adjust for backlash during operation.



Thrust Bearings

Stepper motors are not designed for axial loads so a thrust bearing assembly is included in the design. The thrust bearings, colored green in the picture, prevent axial loads from affecting the stepper motor. Spring washers and a shaft collar are used to preload the thrust bearings.

A helical beam shaft coupler is used to connect the lead screw to the stepper motor shaft and eliminates any errors in shaft alignment due to assembly.



Motor Selection

Stepper motor selection is based on the lead screw and the load to move. The calculations above outline this and show that a torque rating of a minimum of 132.3 oz-in is needed to move the platform. Anaheim Automation model 23Y102D-LW8 has a torque of 175 oz-in that is more than sufficient for lifting.

Distributor	Type	Hand	Diameter [in]	TPI	Pitch [in]	Length [in]	Resolution [in/step]
Haydon-Kerk	ACME-M	RH	0.375	10	0.1000	24	0.0005000

Platform Properties	
AI Volume	11.306 in ³
AI Density	0.098 lbm/in ³
AI Weight	1.108 lbm
Weight Factor	4.000
Total W	4.432 lbm

Stepper Rotation	
Steps	200
Degree	1.8

Lift Torque Calculation	
D	0.375 in
TPI	10
Weight	4.432 lbm
μ	0.25
L	142.703 lbf
l	0.1000 in
R	0.1875 in
r	0.1625 in
F	44.112 lbf
F _l	8.271 lbf - in
T _{oz}	132.336 oz - in

Machinery's Handbook 29th	
Formula - Lift	
$F = L \frac{l + 2r\pi\mu}{2r\pi - \mu l} \cdot \frac{r}{R}$	
F	is force applied at end of lever arm
L	is load moved by lead screw
R	is length of lever arm
l	is lead of screw thread
r	is pitch radius of screw
μ	is coefficient of friction
D	is diameter of lead screw
TPI	is threads per inch
T	is torque on motor

Decent Torque Calculation	
D	0.375 in
TPI	10
Weight	4.432 lbm
μ	0.25
L	142.703 lbf
l	0.1000 in
R	0.1875 in
r	0.1625 in
F	18.356 lbf
T	3.442 lbf - in
T _{oz}	55.069 oz - in

Machinery's Handbook 29th	
Formula - Descent	
$F = L \frac{2r\pi\mu - l}{2r\pi + \mu l} \cdot \frac{r}{R}$	
F	is force applied at end of lever arm
L	is load moved by lead screw
R	is length of lever arm
l	is lead of screw thread
r	is pitch radius of screw
μ	is coefficient of friction
D	is diameter of lead screw
TPI	is threads per inch
T	is torque on motor