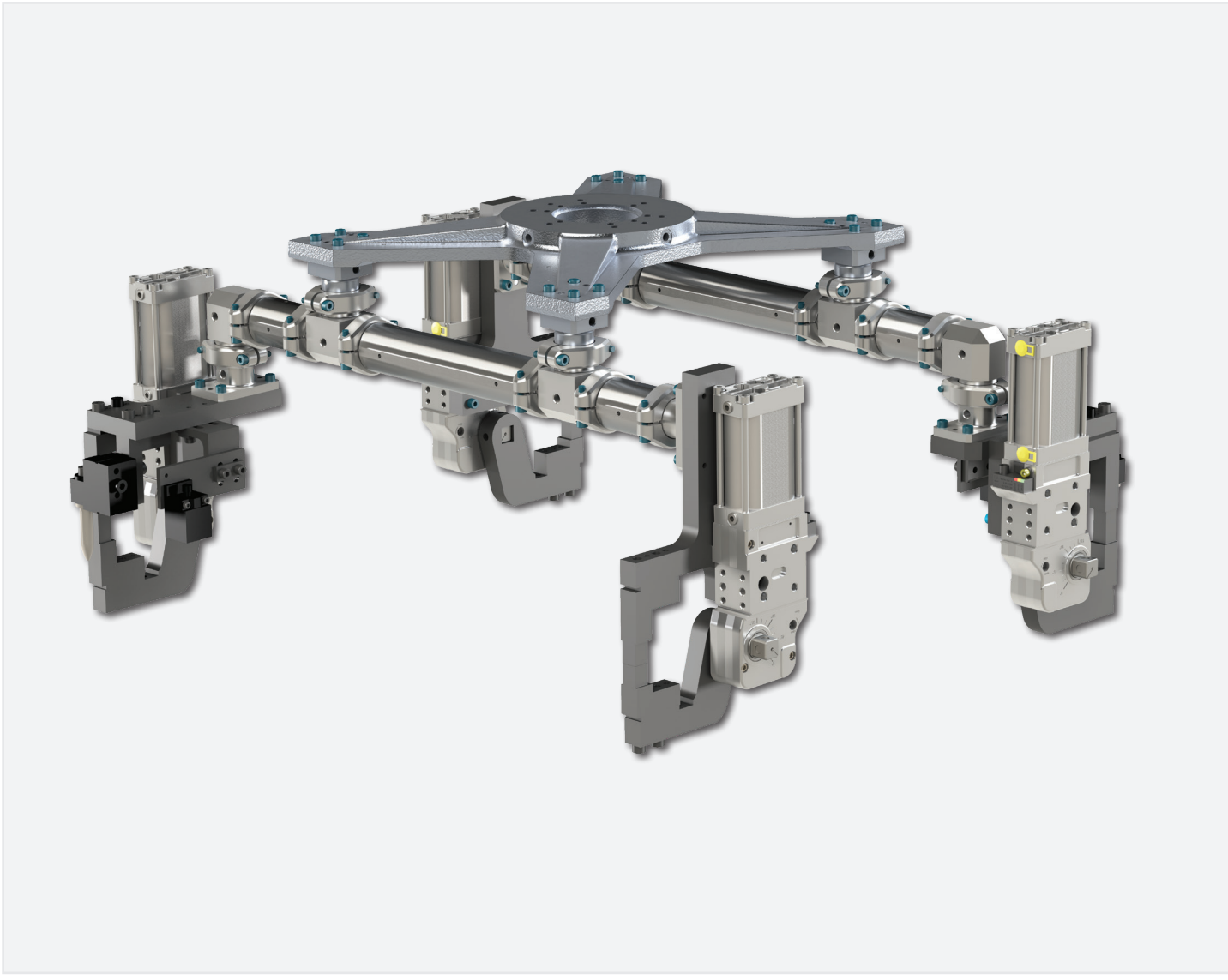
SPIDER GRIP

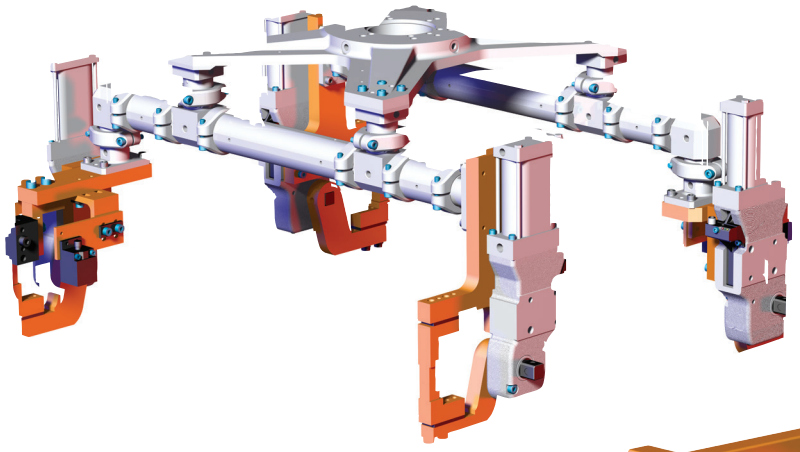
Modular End Effector Design Handbook



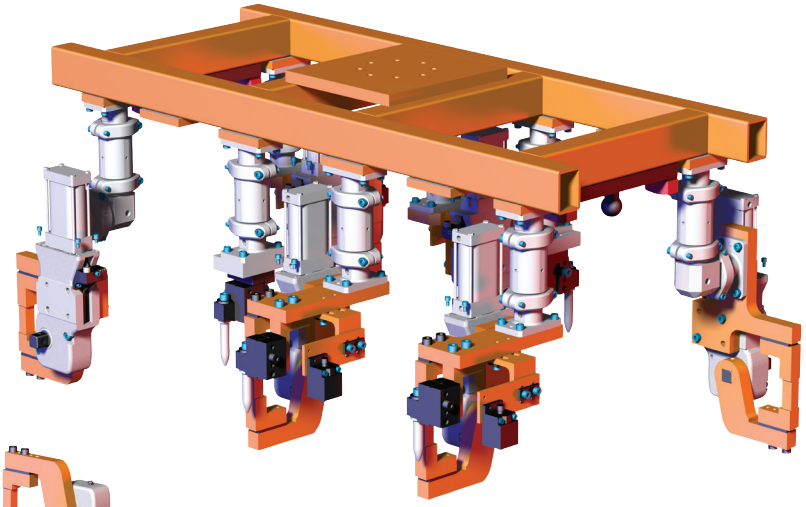
WARNING: This is a controlled document. It is your responsibility to deliver this information to the end user of the DESTACO product. Failure to deliver this could result in your liability for injury to the user or damage to the machine. For copies of this manual, call your Customer Service Representative at 1-800-645-5207.

SPIDERGRIP GEOMETRIC END EFFECTOR SYSTEM

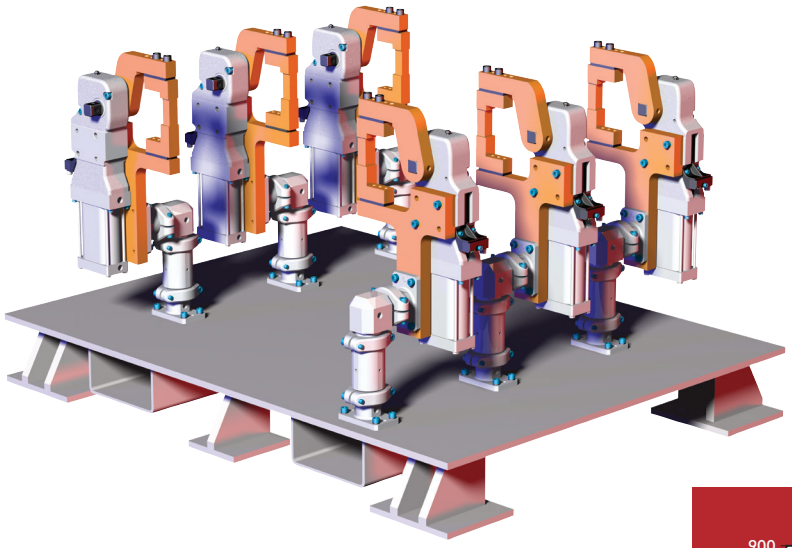
Product Overview



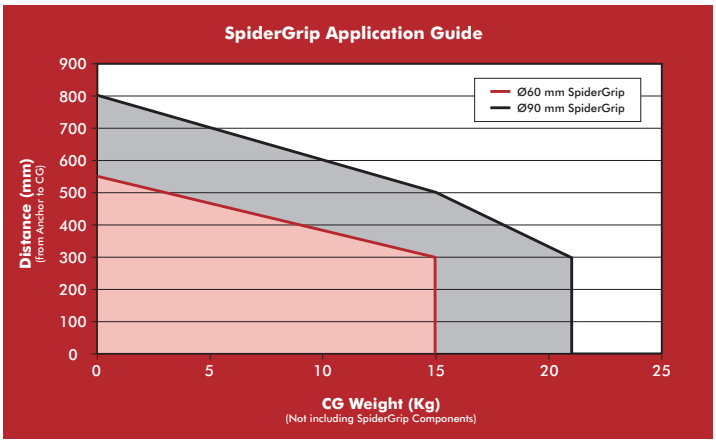
Materials Handling End Effector Tooling System with RM4 Heavy Duty Mid-Mount Assembly (RM4-STS)



Geometric End Effector Tooling System with Steel Frame Backbone



Weld Fixture Tooling System



DESTACO
A STABILUS COMPANY

The SpiderGrip modular end-effector is a tool made for handling, process and\or geometry, designed for all types of panels.

Through a robot interface, it is designed to adapt itself for the standards of all robots with an ISO-Flange, or any other models with a specific interface.

It can be equipped with a bus-system (like InterBus, ProfiBus, CanBus, etc…).

An ISO tool changer can be adapted on it .

The modular end-effector can also be associated to other tools:

- A welding gun,
- a stud inserter system,
- etc…

In the case of a welding gun, a common support must be considered and taken into account in the geometry. (Possibility of dismounting separately the tools from the end-effector.)

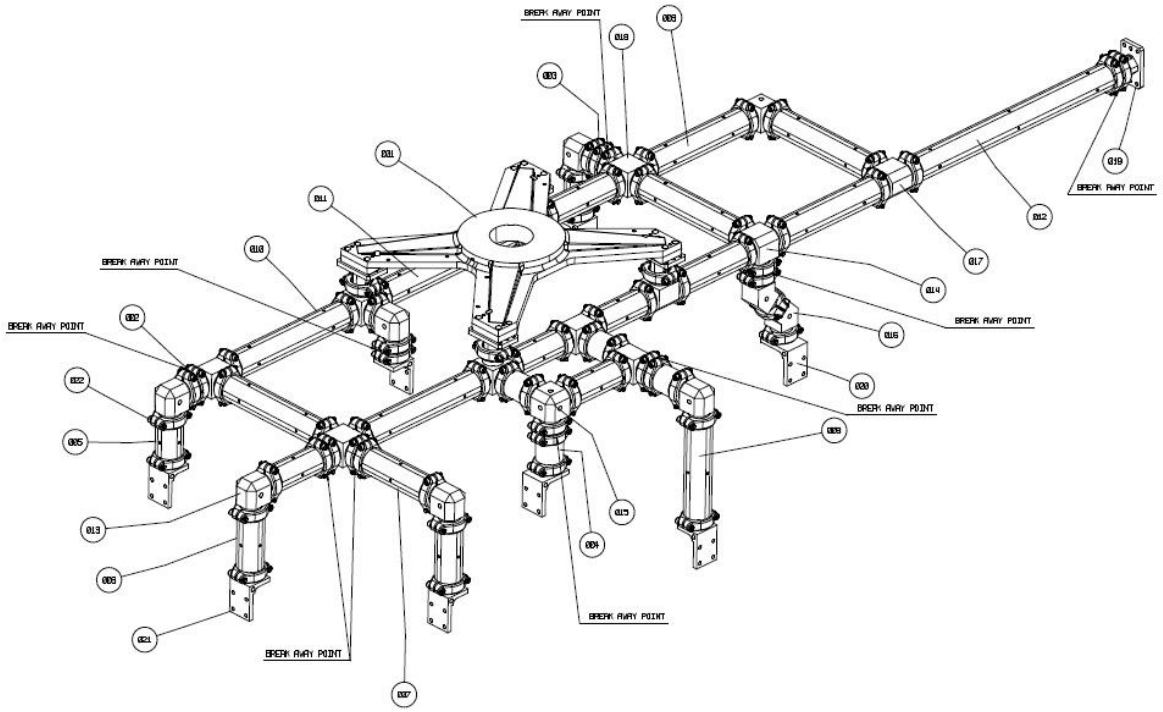
The engineering of a modular end-effector must take into account indexing positions between the installation scheme on the 6 axis of the robot (pin) and the installation scheme of the robot adapter (keys or pins).

From the beginning to the final assembly, these orders owe beings respected scrupulously, to be able to guarantee interchangeability, those indications must be tightly followed in order to insure easy replacement on site.

The various standard elements of the end-effector are digitized to make feasibility simulations.

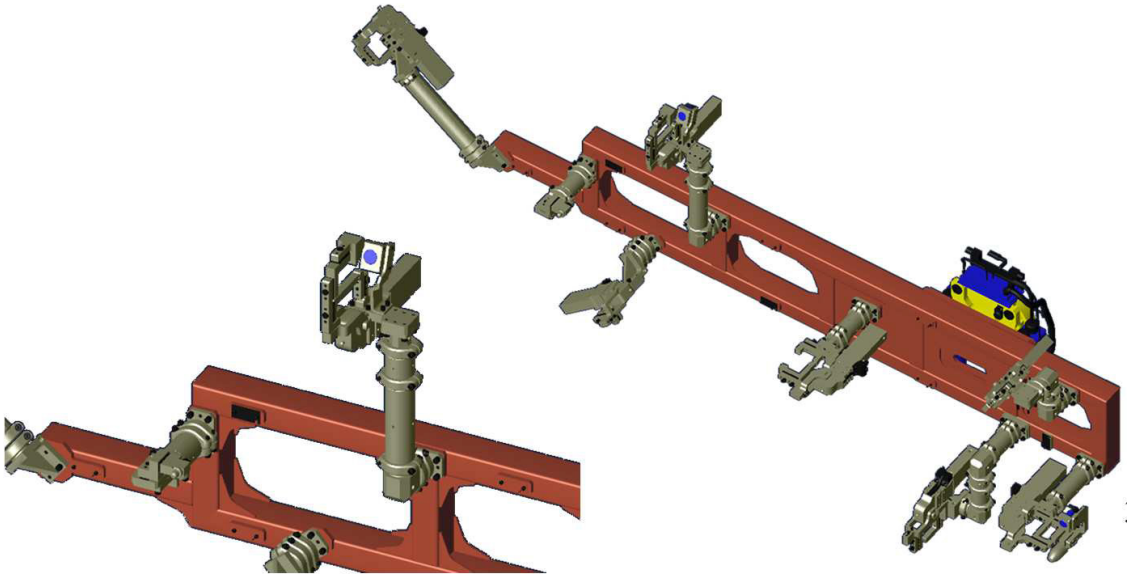
SPIDERGRIP END EFFECTOR FOR HANDLINGAND PROCESS APPLICATIONS

Example:



SPIDERGRIP END EFFECTOR FOR GEOMETRICAL APPLICATIONS

Example:



SPIDERGRIP END EFFECTOR FOR GEOMETRICAL

APPLICATIONS AND LARGE PANELS

Conditions and Tolerances (Repeatability):

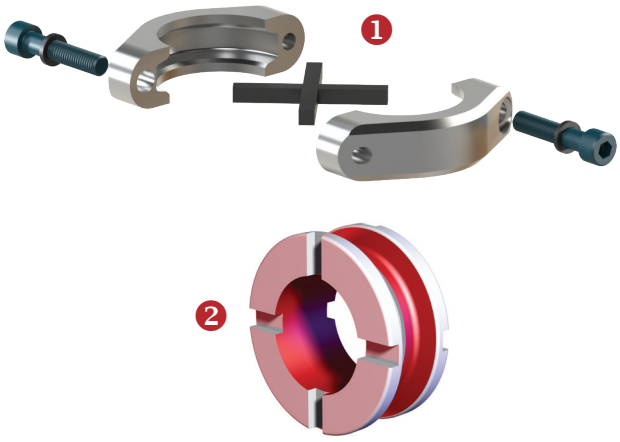
With max. boom length 350mm:

- holds certified points in a max. tolerance of 0,1 mm throughout the lifecycle
- holds up minor collisions during robot setup while maintaining dimensional certification
- Recovery from collision without re-certification
  - Time to repair, medium 10 Minutes (min. 5 max. 15 Minutes), see following description
- Life cycle testing 3 million cycles (MTBF)

RECOVERY FROM CRASH

If a crash has happened, normally like in this picture, that the predictable breakaway part is broken, following action have to be done for the recovery:

1. Disassemble the two collars at the breakaway part using an Allen-Wrench for M8 screws
2. Substitute the broken part with a new one
   - Be sure to have inserted the two cross keys in the new breakaway part
   - Reassemble the two collars at the breakaway part using an Allen-Wrench for M8 screws
   - Time to repair, between 5 and 10 Minutes)



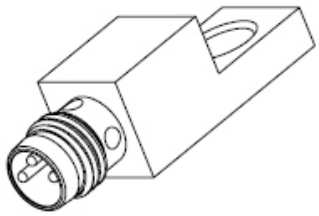
No further action, no measurement needed!

BREAKAWAY CONTROLLING

Each breakaway joint can be controlled, which means if it breaks, the robot controller gets a signal and the movement of the robot will be stopped immediately.

Following the needed components are shown:

Shunt



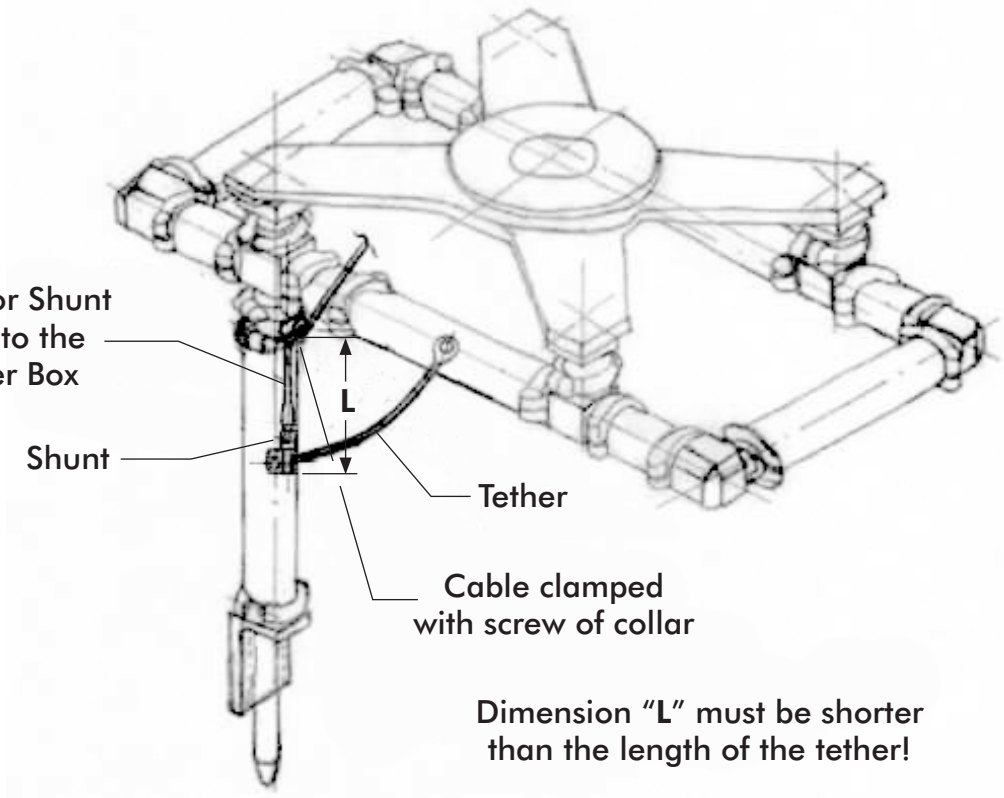
Cable

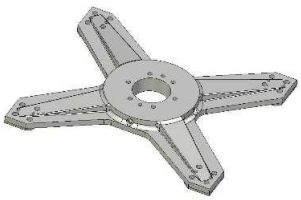
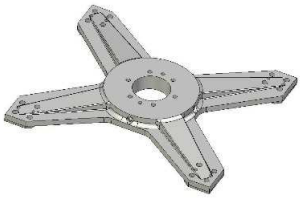
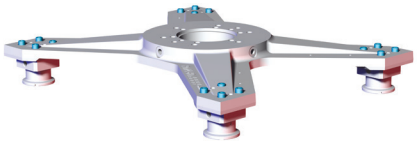
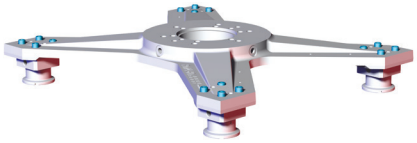
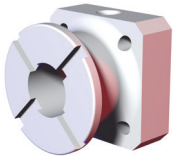
Plug to secure serial function if no shunt is installed

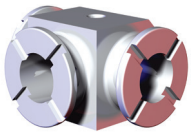
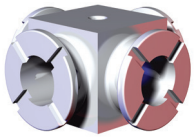
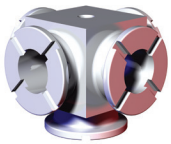
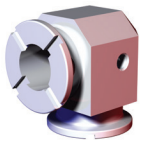
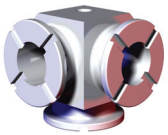
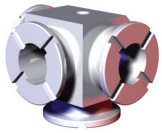
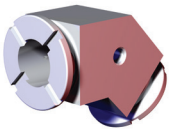
Splitter Box

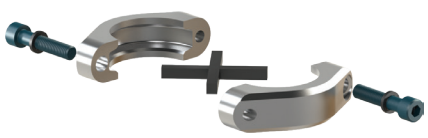
Attention!

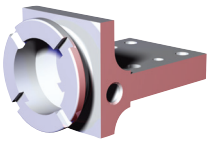
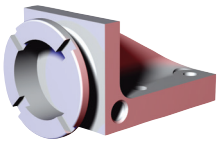
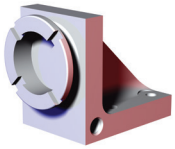
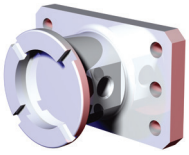
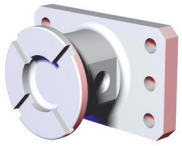
Mounting of the breakaway controlling components:



ROBOT MOUNTS		
Picture	Desgination	Reference
	**RM4 Robot-Mount Casting** For Robot COMAU NH 3, NH 4 and Tool Changer Walther Praezision	RM4-STS-R13-01
	**RM4 Robot-Mount Casting** For Robot COMAU NJ	RM4-STS-R14-01
	**RM4 Robot-Mount Casting** For Robot COMAU NH 3, NH 4 and Tool Changer Walther Praezision	RM4-STS-R13
	**RM4 Robot-Mount Casting** For Robot COMAU NJ	RM4-STS-R14
	**BM2 Robot** Mount Block	STS0013-BM2

JUNCTIONS		
Picture	Desgination	Reference
	**60 mm JUNCTION BRACKET 3 FACES**	STN0T3F-NA
	**60 mm JUNCTION BRACKET 4 FACES**	STN0T4F-NA
	**60 mm JUNCTION BRACKET 5 FACES**	STN0T5F-NA
	**60 mm ELBOW BRACKET 90°**	STN0C90-NA
	**60 mm ELBOW BRACKET 3 FACES**	STNC3F-NA
	**60 mm JUNCTION BRACKET 4 FACES**	STN0C4F-NA
	**60 mm ELBOW BRACKET 45°**	STN0C45-NA

COLLARS		
Picture	Desgination	Reference
	**60 mm COLLAR ASSEMBLY**	STCCLRX-NA

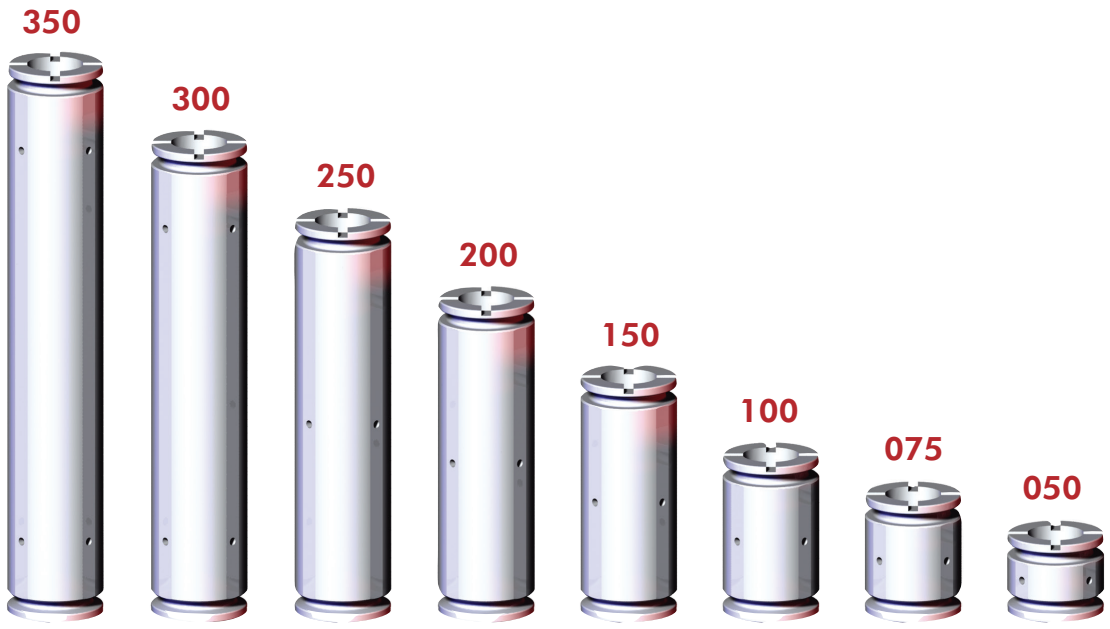
EDGES		
Picture	Desgination	Reference
	**60 mm MOUNTING BRACKET 90**	STS0010-NA-2P
	**60 mm MOUNTING BRACKET 90**	STS0011-NA-2P
	**60 mm MOUNTING BRACKET 90**	STS0012-NA-2P
	**60 mm MOUNTING BRACKET OFFSET**	STS0014-NA-2P
	**60 mm Breakaway BRACKET 50 mm**	STS0016-NA-2P
	**60 mm ANCHOR BRACKET 50 mm**	STS0019-NA-2P

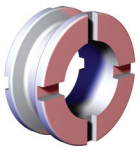
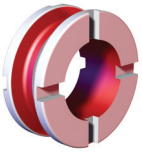
SUPPORTS		
Picture	Desgination	Reference
	**SUPPORT 1**	STE0010
	**SUPPORT 2**	STE0020

BOOMS	
Desgination	Reference
60 mm TUBE 050	STB0050-NA
60 mm TUBE 075	STB0075-NA
60 mm TUBE 100	STB0100-NA
60 mm TUBE 150	STB0150-NA

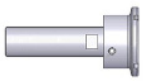
BOOMS	
Desgination	Reference
60 mm TUBE 200	STB0200-NA
60 mm TUBE 250	STB0250-NA
60 mm TUBE 300	STB0300-NA
60 mm TUBE 350	STB0350-NA

Note: Booms lengths of 400 mm to 600 mm, in 50 mm increments, can be order upon request.



BOOM SPACERS		
Picture	Desgination	Reference
	**60 mm TUBE 025** NON-BREAKAWAY JOINT	STB0025-NA
	**60 mm TUBE 025** BREAKAWAY JOINT	STB0025-BA-800

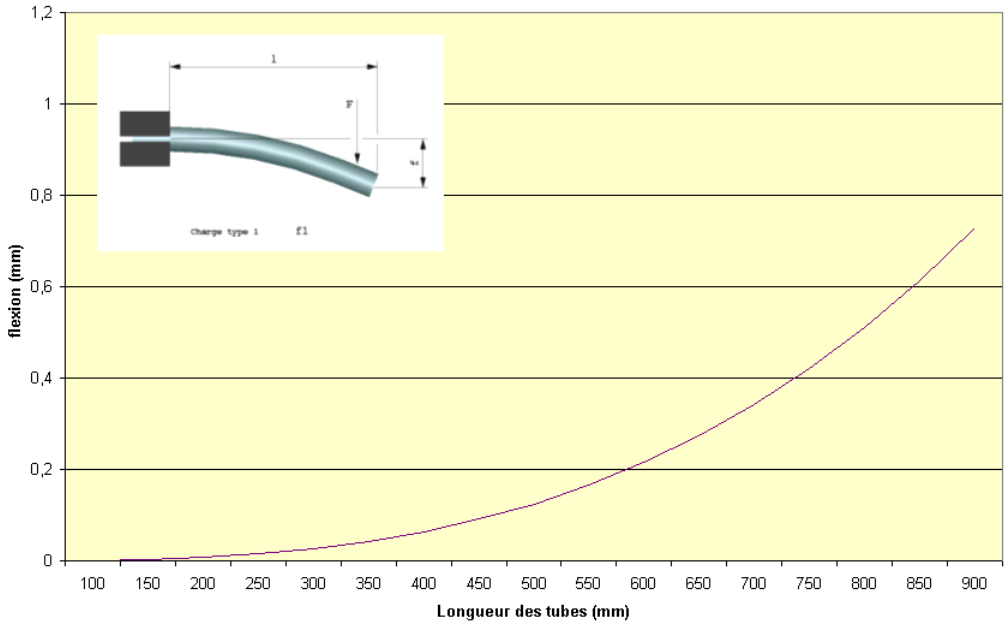
TETHER		
Picture	Desgination	Reference
	**9 in. TETHER**	STS-TETHER-09
	**16 in. TETHER**	STS-TETHER-16

EQUIPMENT		
Picture	Desgination	Reference
	**SUPPORT ARM ASSY.** 25mm-100 LG	STV0100-NA
	**SUPPORT ARM ASSY.** 2mm-200 LG	STV0200-NA
	**EDGE SUPPORT ARM**	STV0300-NA

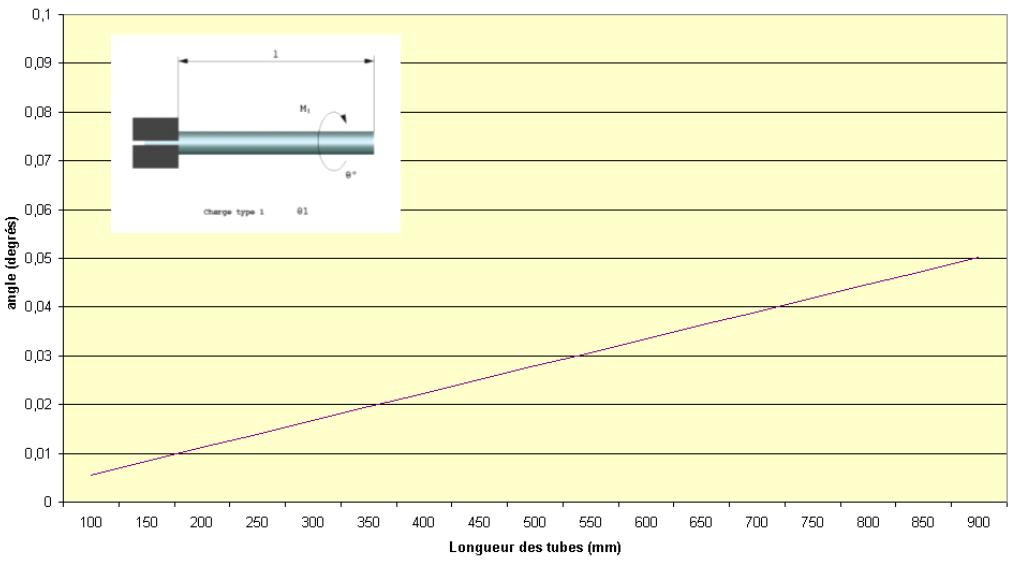
SUMMARY OF PARTS		
Designation	Reference	Weight in Kg
ROBOT MOUNT		
RM4 ROBOT MOUNT CASTING	**RM4-STS-R13-01**	10.435
RM4 ROBOT MOUNT CASTING	**RM4-STS-R14-01**	10,435
RM4 ROBOT MOUNT ASSEMBLY	**RM4-STS-R13-01**	11,363
RM4 ROBOT MOUNT ASSEMBLY	**RM4-STS-R14-01**	11,363
BM2 ROBOT MOUNT BLOCK	**STS0013-BM2**	0,232
COLLARS		
60 mm COLLAR ASSEMBLY	**STMCCLRX-NA**	0,115
BOOMS		
60 mm TUBE 050	**STB0050-NA**	0,197
60 mm TUBE 075	**STB0075-NA**	0,322
60 mm TUBE 100	**STB0100-NA**	0,447
60 mm TUBE 150	**STB0150-NA**	0,697
60 mm TUBE 200	**STB0200-NA**	0,947
60 mm TUBE 250	**STB0250-NA**	1,197
60 mm TUBE 300	**STB0300-NA**	1.444
60 mm TUBE 350	**STB0350-NA**	1,694
BOOM SPACERS		
Ø60mm 25mm NON-BREAKAWAY	**STB0025-NA**	0,8
Ø60mm 25mm BREAKAWAY	**STB0025-NA-800**	0,8
JUNCTIONS		
60 mm JUNCTION BRACKET 3 FACES	**STNOT3F-NA**	0,595
60 mm JUNCTION BRACKET 4 FACES	**STNOT4F-NA**	0,666
60 mm JUNCTION BRACKET 5 FACES	**STN0T5F-NA**	0,707
60 mm ELBOW BRACKET 90°	**STN0C90-NA**	0,526
60 mm ELBOW BRACKET 3 FACES	**STN0C3F-NA**	0,584
60 mm JUNCTION BRACKET 4 FACES	**STN0C4F-NA**	0,65
60 mm ELBOW BRACKET 45°	**STN0C45-NA**	0,423
EDGES		
60 mm MOUNTING BRACKET 90	**STS0010-NA-2P**	0,314
60 mm MOUNTING BRACKET 90	**STS0011-NA-2P**	0,348
60 mm MOUNTING BRACKET 90	**STS0012-NA-2P**	0,468
60 mm ANCHOR BRACKET 50 mm	**STS0013-NA-2P**	0.232
60 mm MOUNTING BRACKET OFFSET	**STS0014-NA-2P**	0,386
60 mm MOUNTING BRACKET 25 mm	**STS0015-NA-2P**	0,213
60 mm ANCHOR BRACKET 50 mm	**STS0016-NA-2P**	0,309
SUPPORT ARM ASSY.		
25 mm DIA. 100 mm Lg.	**STV0100-NA**	0,249
25 mm DIA. 200 mm Lg.	**STV0200-NA**	0,381
EDGE SUPPORT ARM		
EDGE SUPPORT ART	**STV0300-NA**	0,12
TETHER		
9 in. TETHER	**STS-TETHER-09**	0,11
16 in. TETHER	**STS-TETHER-16**	0.15

MECHANICAL CALCULATIONS: BOOM

FLEXION f1 f1=(F.L^3)/(3.E.I.10^4) pour un effort de 200N



TORSION q1 q1=(180.Mt.L)/(pi.G.J.10^4) pour un moment de 50000 Nmm



TESTS

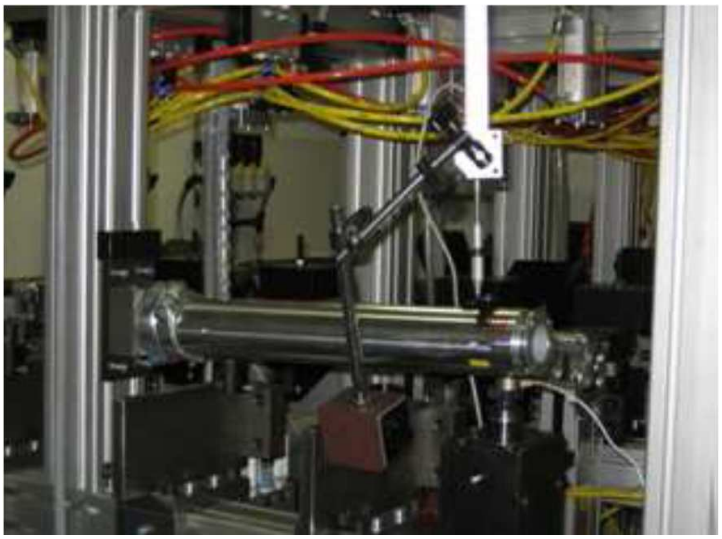
Breakaway Part - STS0025-BA-800

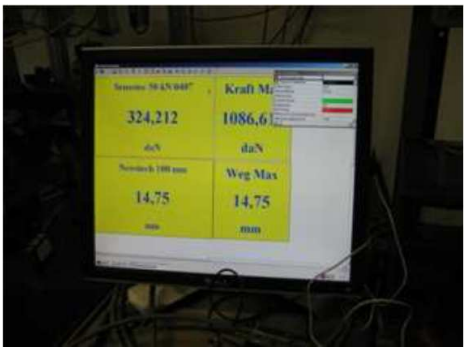
Consideration:

It is important, on one side, that the breakaway part is not too weak, so that it breaks with max. acceleration or deceleration and emergency stop of the robot. On the other side it has not to be too strong, because it has to break before irreversible deformation can happen or that the end effector is out of tolerance.

To assure that, calculations and the following tests were made:

The breakaway joint has been tested for fracture with the result that with a moment of 790 Nm it breaks.





TESTS

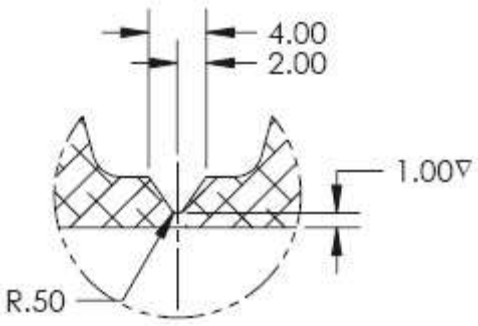
Breakaway Part - STS0025-BA-800

The fatigue live test did not show problems during 3,6 million cycles.

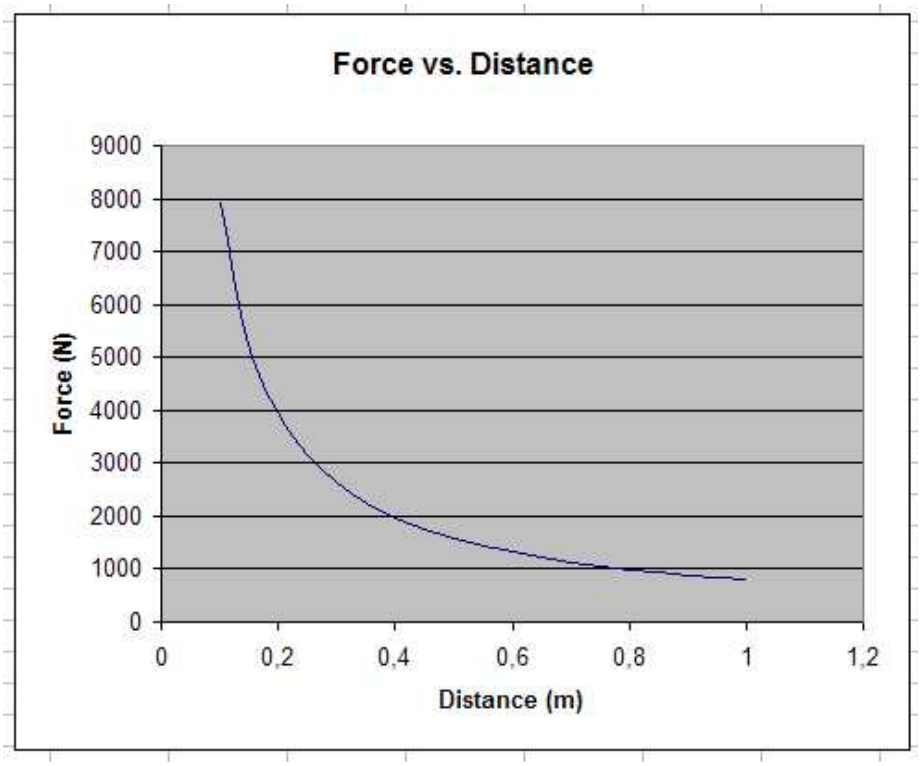
TESTS

Breakaway Part - STS0025-BA-800

The wall thickness has been reduced to 1 mm



And here is a diagram for the usage of the breakaway part:



DESIGN AND ASSEMBLY - GUIDELINES

1) No modification to Spider Grip parts are permitted.

2) All materials are high-grade Aluminum. This also means corrosion when married to steel parts is not an issue. DE-STA-CO recommends to use Aluminum for the non-standard end effector components

3) Each non standard end effector arrangement should not weigh more than 10Kg.

4) The gripper should not exceed 500K g

5) Reference dowels are located on the BM2 robot interface and on angular components. These are for inspection and assembly. The designer and technician should try to avoid obscuring these areas.

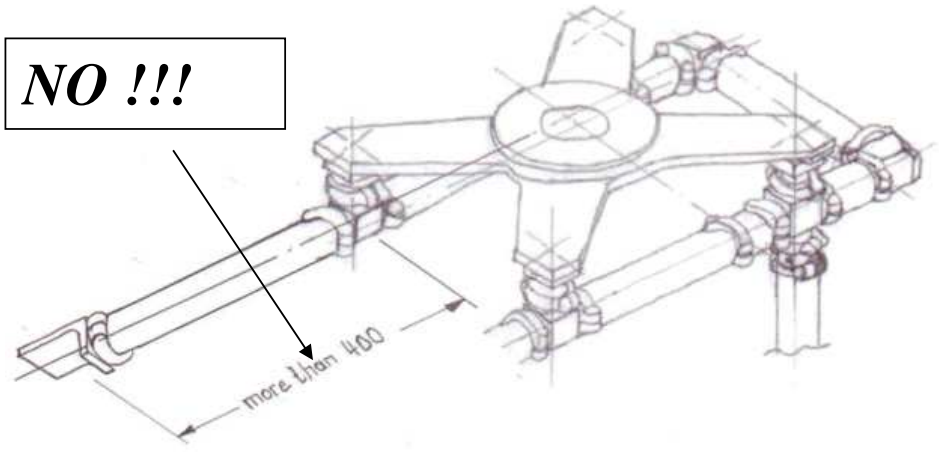
6) In RobCAD the density of components are set slightly higher to compensate for the weight of the pipes and wires. The correct weight can be found in the catalogue.

7) The edge parts of SpiderGrip should be as close to the clamping point / location pin as possible.

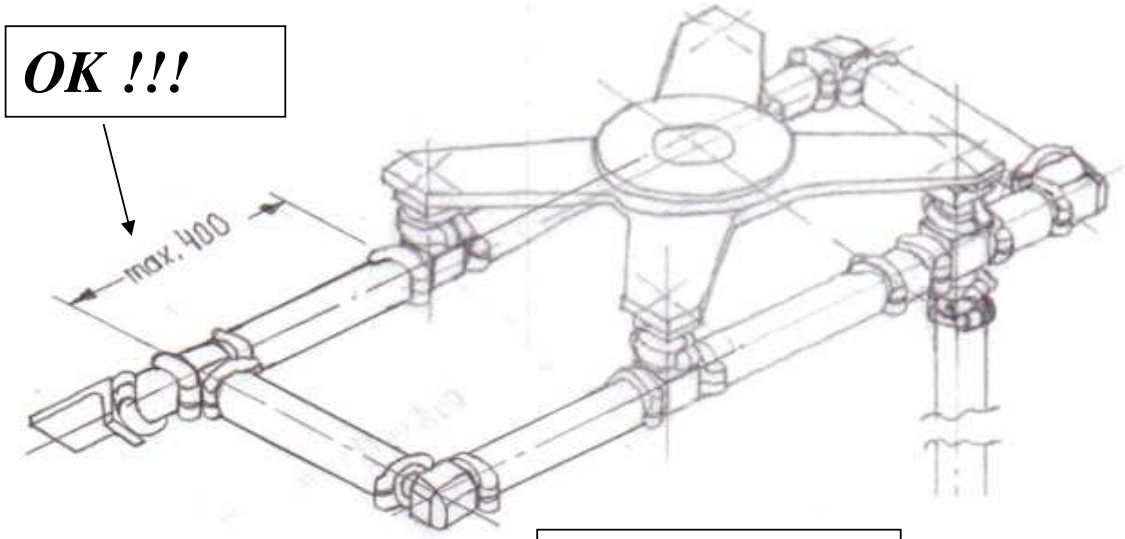
8) All the holes in SpiderGrip edge parts are machined with tolerance H7.

9) Actually only one size of the BM2 Robot-Mount is available. The designer has to choose what kind of hole pattern (see following pages) is needed for the type of robot or an automatic tool changer, etc. This information has to be transferred to DE-STA-CO at least 3 weeks before the delivery date.

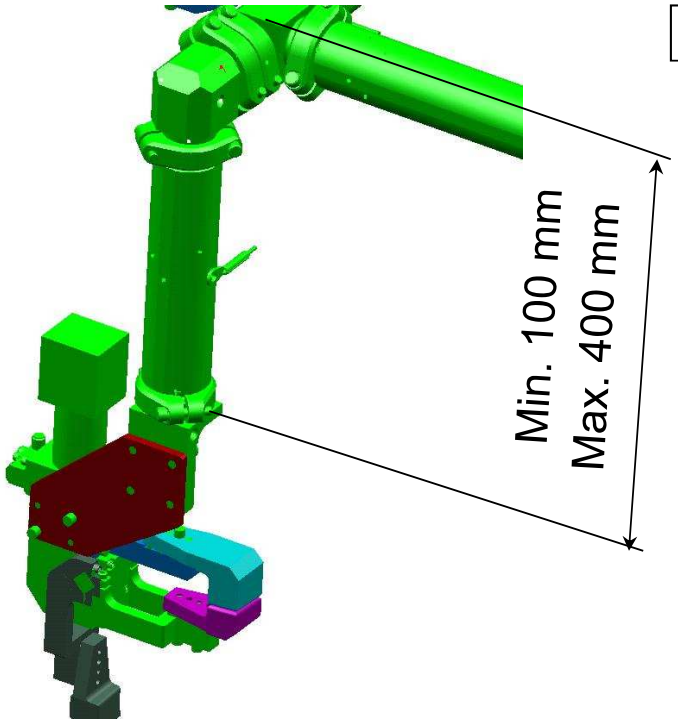
10) Every end effector or appendage on an end effector, that is carrying a power clamp or an actuated pin, that is longer than 400 mm needs to have a closed frame solution.



DESIGN AND ASSEMBLY - GUIDELINES



Closed Frame Solution

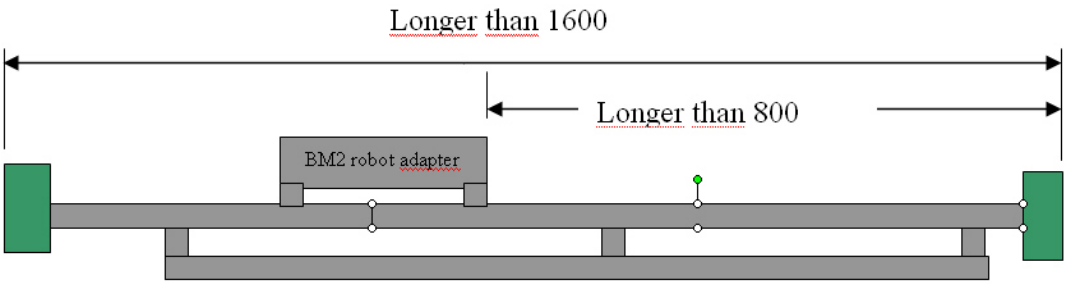


Length of Appendages

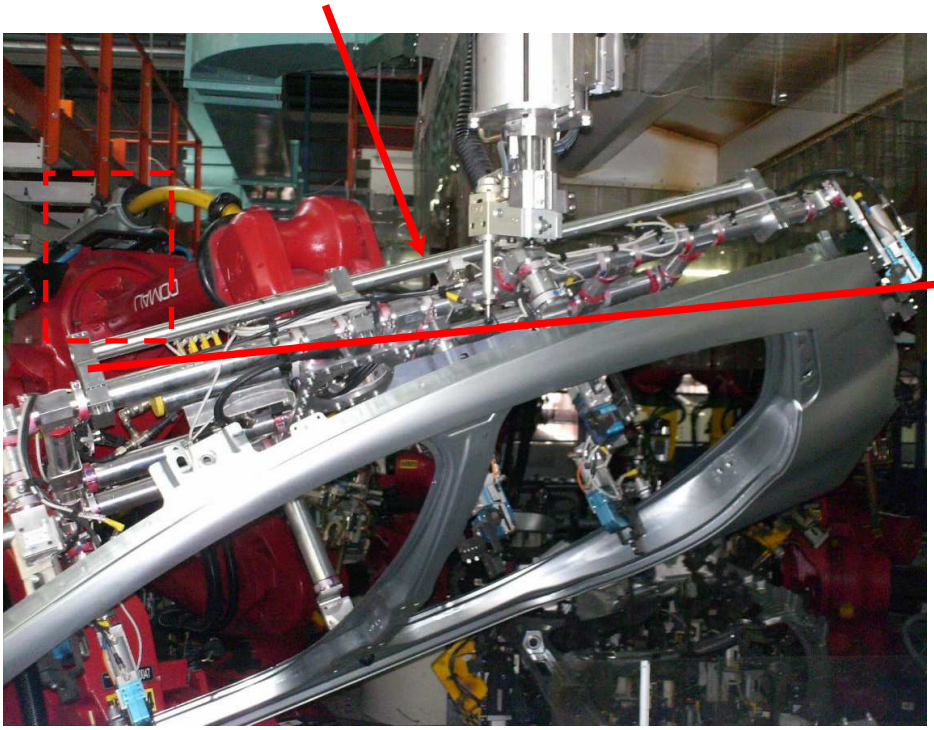
DESIGN AND ASSEMBLY - GUIDELINES

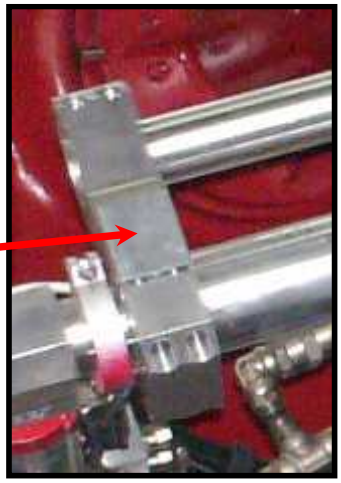
11) Exception can be made where the end effector carries something light as for example a sensor, proximity switch or similar.

12) If one side of the gripper is longer than 800 mm or if the total gripper is longer than 1600 mm, a second level of tubing has to be used to maintain the rigidity and to avoid fractures due to fatigue. See example and pictures below of how to strengthen the structure.



Alternative reinforcement





DESIGN AND ASSEMBLY - GUIDELINES

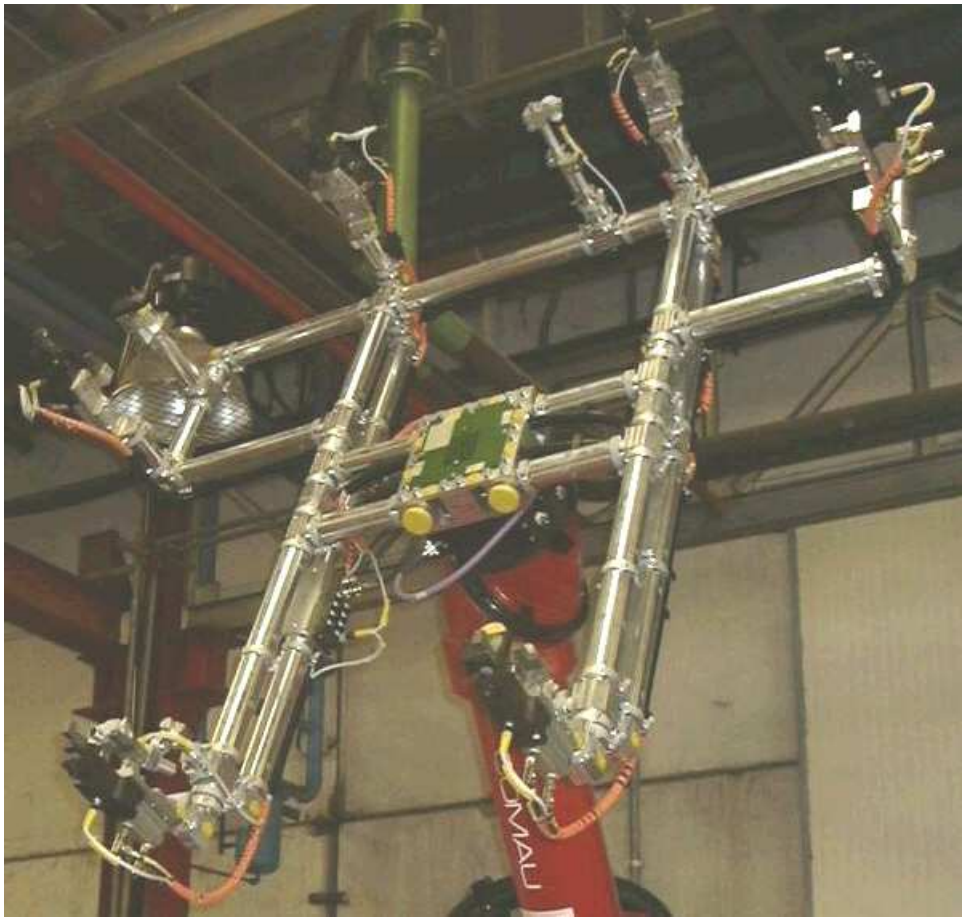
13) Even though there are several rules given by DE-STA-CO regarding the design of the grippers. Ultimately it is up to the designer to use common sense and judgement with regards to the grippers rigidity.

14) On the mounting joint of the appendages, to the main structure of the gripper, the break-away part “STB0025-BA-800” has to be used. These parts are designed to be the only component that breaks in the event of a crash. It is recommended that during installation of the gripper when programming some of these are available as spares. See example on the following page.

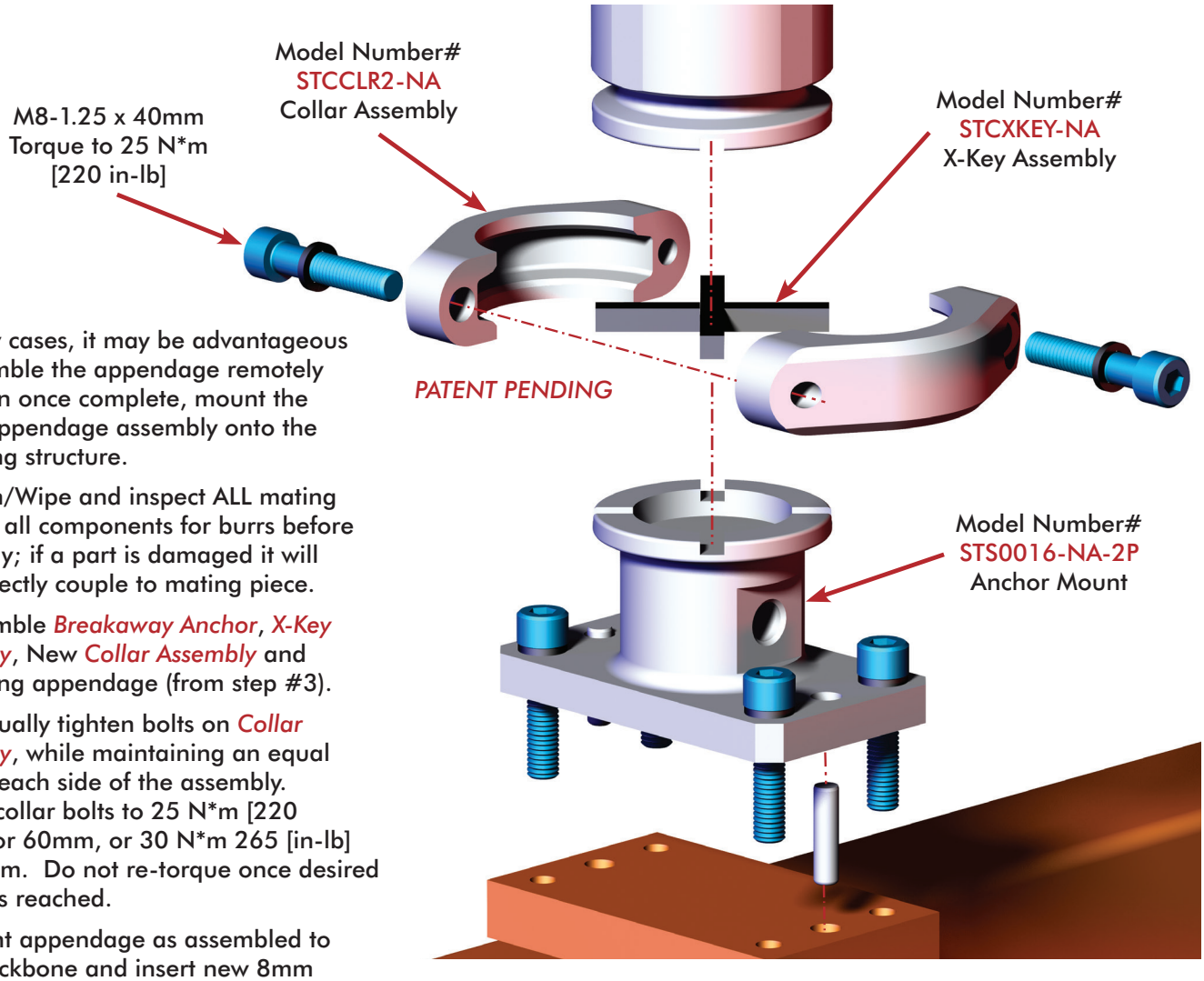
15) Location pins should not be mounted to the smaller modular arms which are designed for the use of proximity switches and suction cups.

16) The BM2 robot adapter is not compulsory and if the design requires can be left out, for example this may be required for very small grippers or gun grippers.

17) There are locking pins on the suction cup module units. These are drilled on assembly after setting.



DESIGN AND ASSEMBLY - FIRST ASSEMBLY INSTRUCTIONS



In many cases, it may be advantageous to assemble the appendage remotely and then once complete, mount the entire appendage assembly onto the mounting structure.

1. Clean/Wipe and inspect ALL mating faces of all components for burrs before assembly; if a part is damaged it will not correctly couple to mating piece.

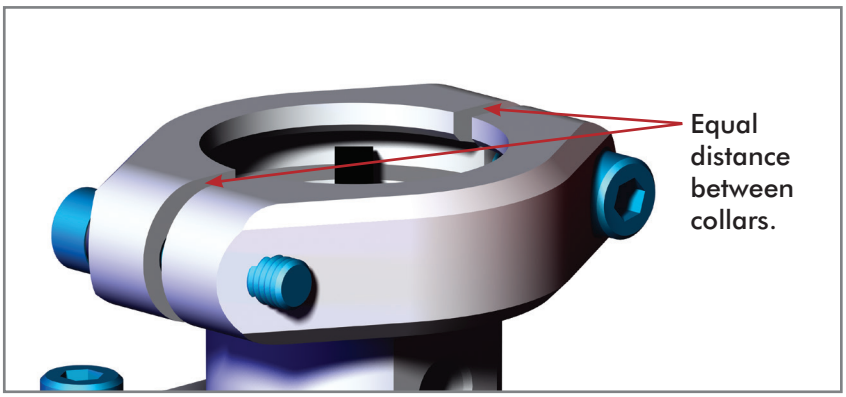
2. Assemble *Breakaway Anchor*, *X-Key Assembly*, New *Collar Assembly* and remaining appendage (from step #3).

3. Gradually tighten bolts on *Collar Assembly*, while maintaining an equal gap on each side of the assembly. Torque collar bolts to 25 N*m [220 in-lb] for 60mm, or 30 N*m 265 [in-lb] for 90mm. Do not re-torque once desired torque is reached.

4. Mount appendage as assembled to steel backbone and insert new 8mm dowels into the dowel holes on the *Breakaway Anchor*.

5. Insert new M8-1.25 patchlock bolts into *Breakaway Anchor*, torque in a cross pattern following NAAMS recommended torque.

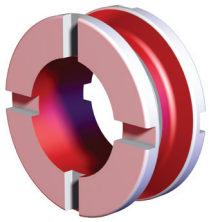
6. Attach steel tether (*STS-TETHER-08 or STS-TETHER-16*) to appendage via one of the bolts located on the base of the *Breakaway Anchor*. The other loop will be attached to the first threaded M6 hole (located on the boom) or the M8 hole located on the edge part. The tether may also be wrapped around the appendage to reduce cable slack.

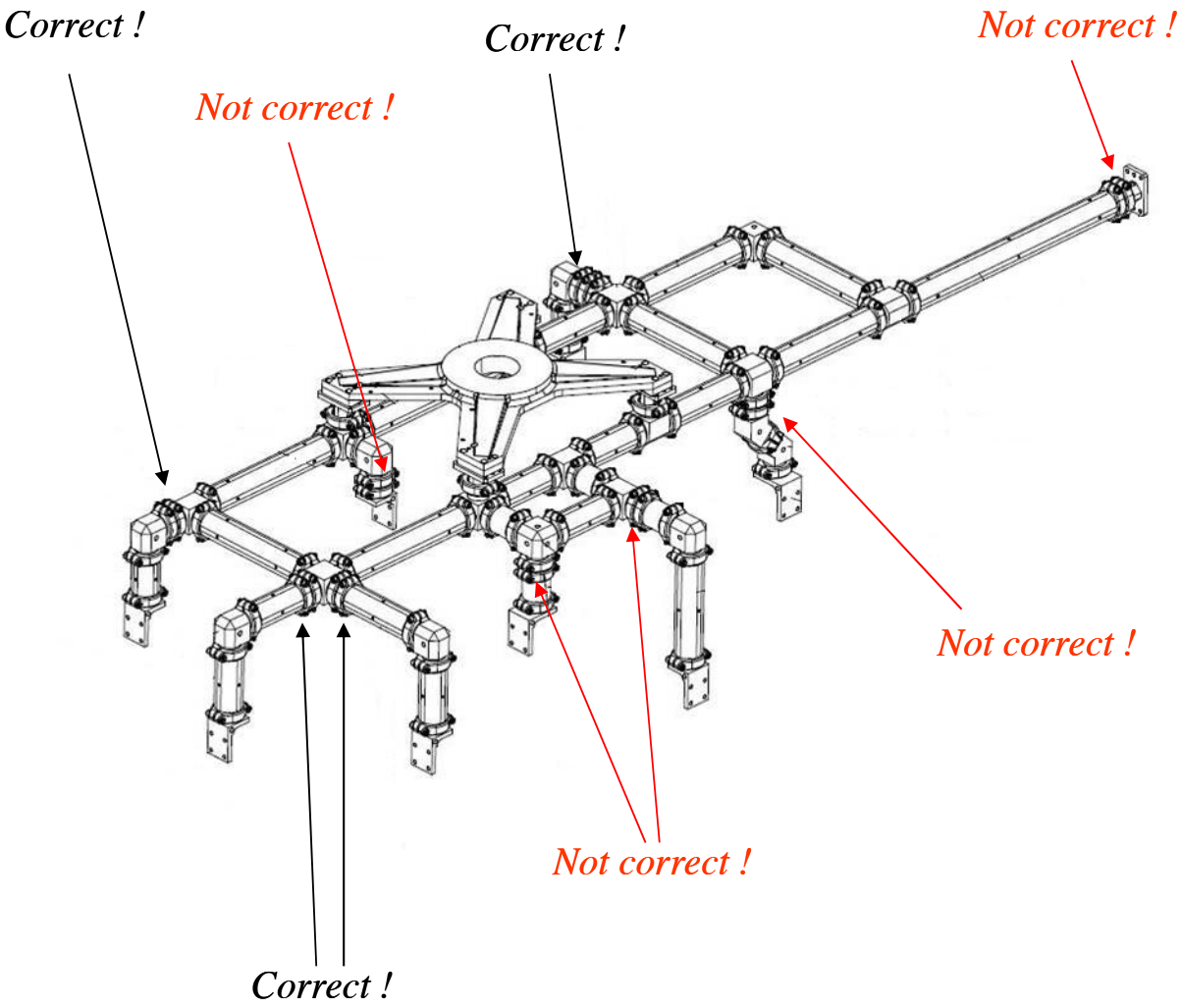


DESIGN AND ASSEMBLY - GUIDELINES

Examples for the correct positioning of the breakaway part

STB0025-BA-800

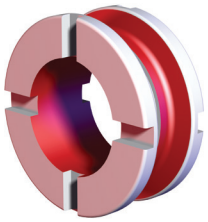


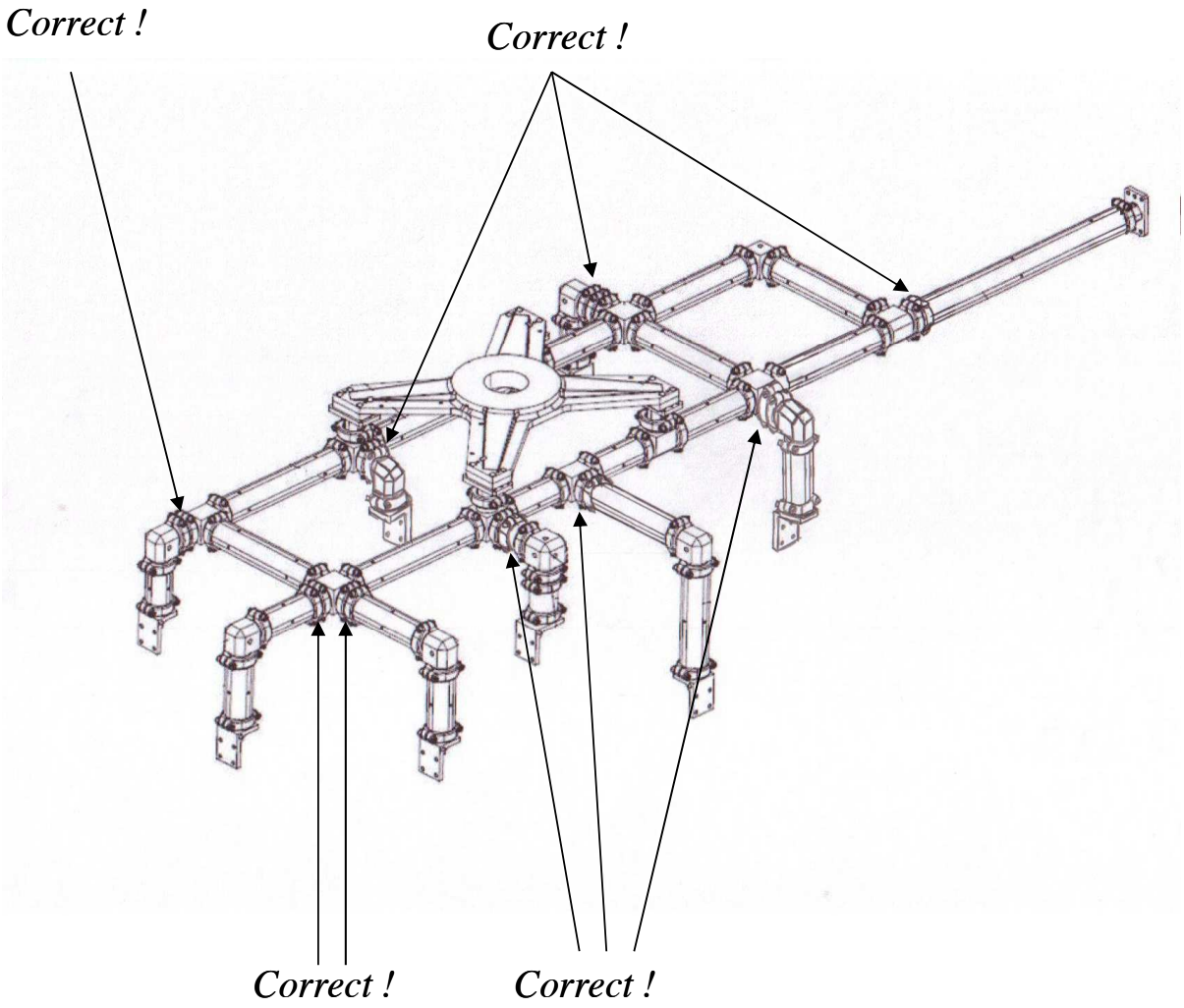


DESIGN AND ASSEMBLY - GUIDELINES

Examples for the correct positioning of the breakaway part:

STB0025-BA-800

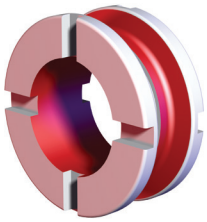


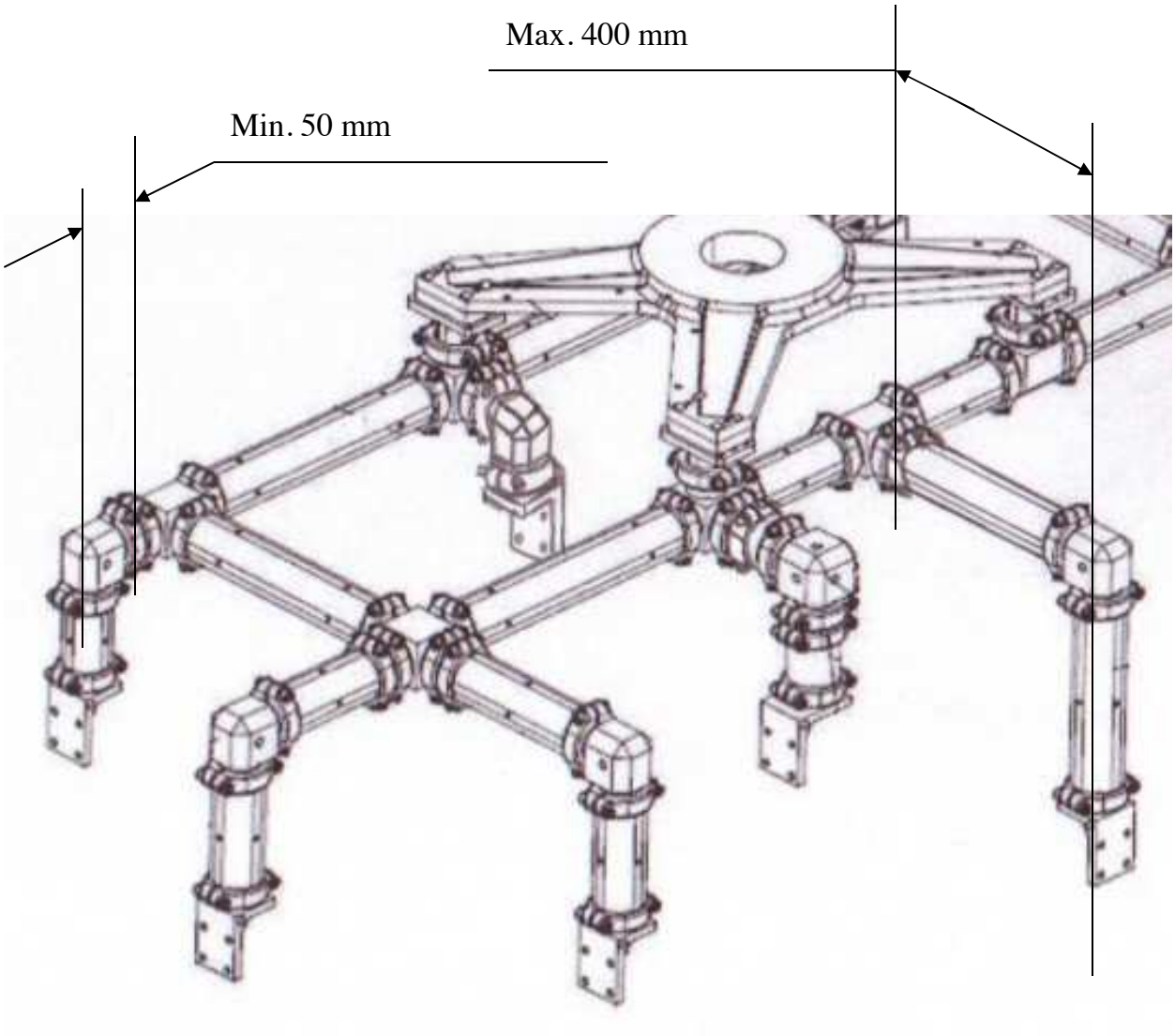


DESIGN AND ASSEMBLY - GUIDELINES

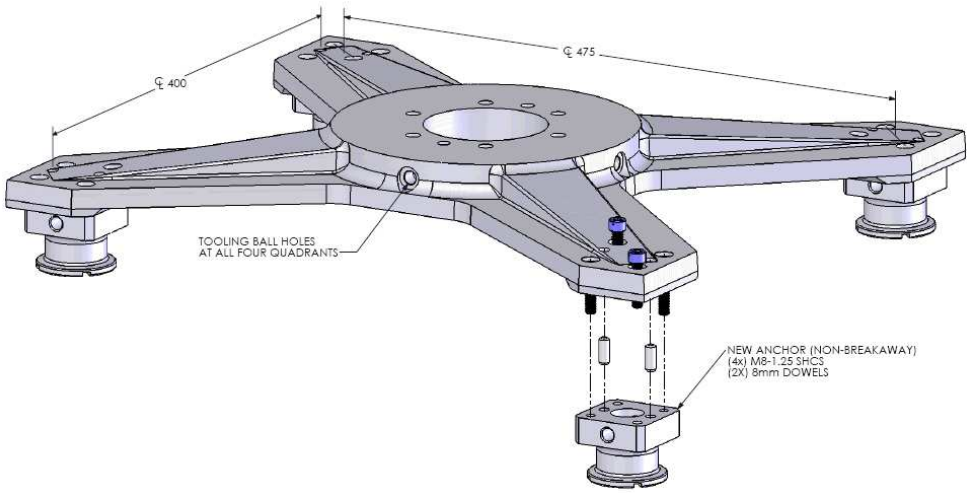
Examples for the correct positioning of the breakaway part:

STB0025-BA-800

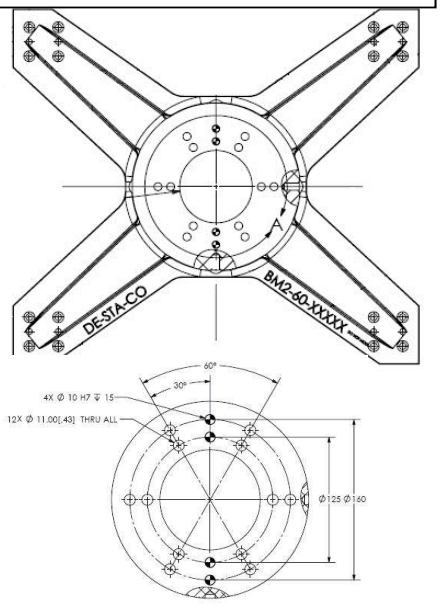


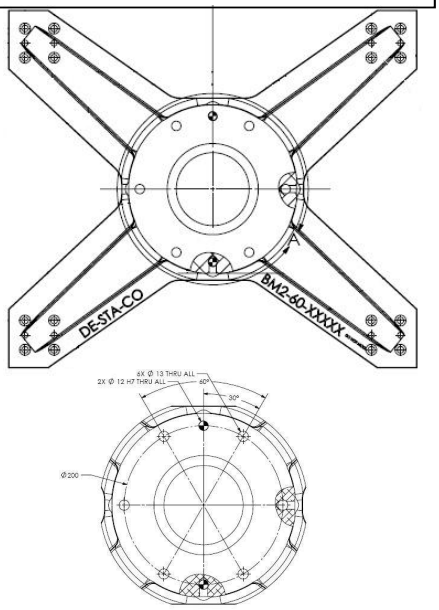


DESIGN AND ASSEMBLY - GUIDELINES



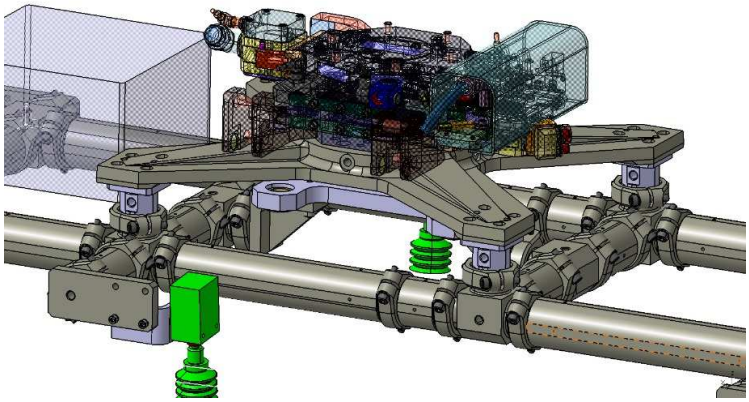
For COMAU-Robot NH3,NH4 and Tool Changer Walther-Praezision	For COMAU-Robot NJ
RM4-STS-R13-01 (only the plate)	RM4-STS-R14-01 (only the plate)
RM4-STS-R13 (assembly)	RM4-STS-R14 (assembly)



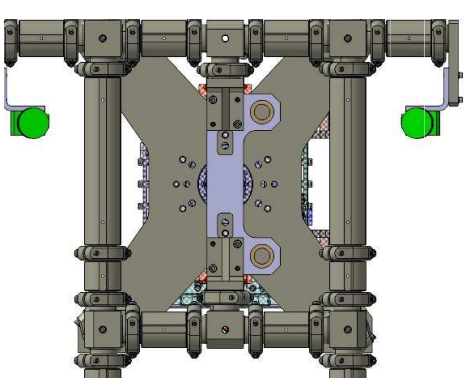


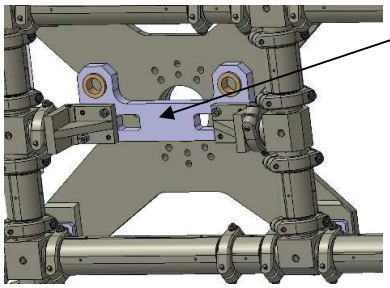
DESIGN AND ASSEMBLY - GUIDELINES

Guideline for automatic tool change and cantering for tool stand.

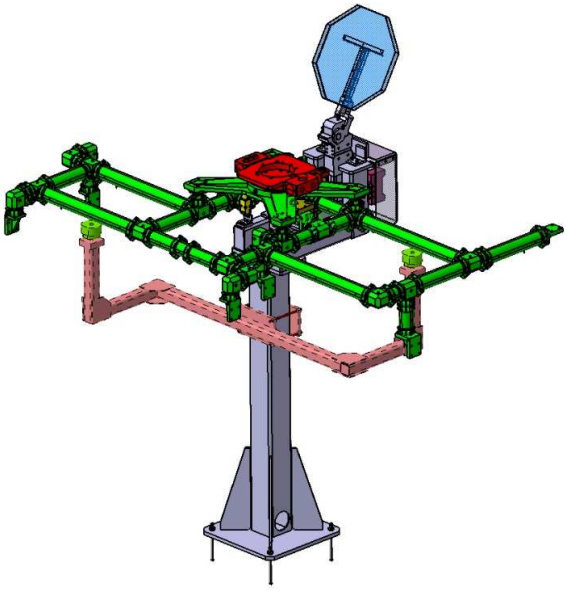


Thickness plate : 20 mm
Distance between holes : 235 mm
Diameter holes : 35H7
Bush : Standard 0039006 (35x26x20)



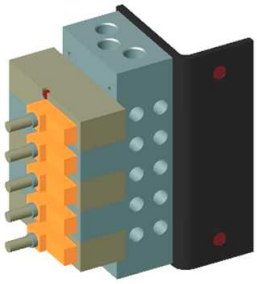


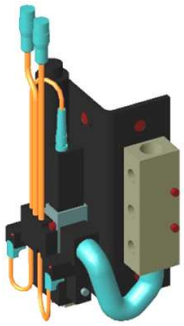
Example of Standard Tool Stand

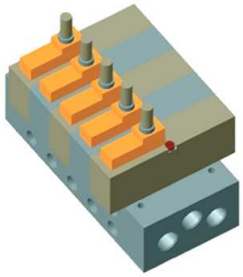


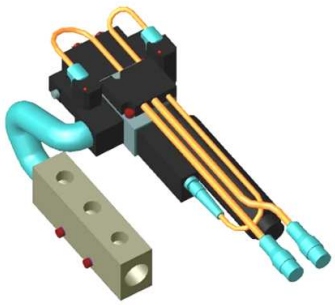
DESIGN AND ASSEMBLY - GUIDELINES

Assembly of Pneumatic Equipment:

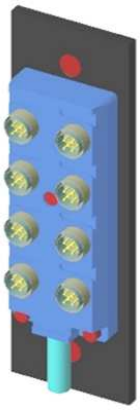






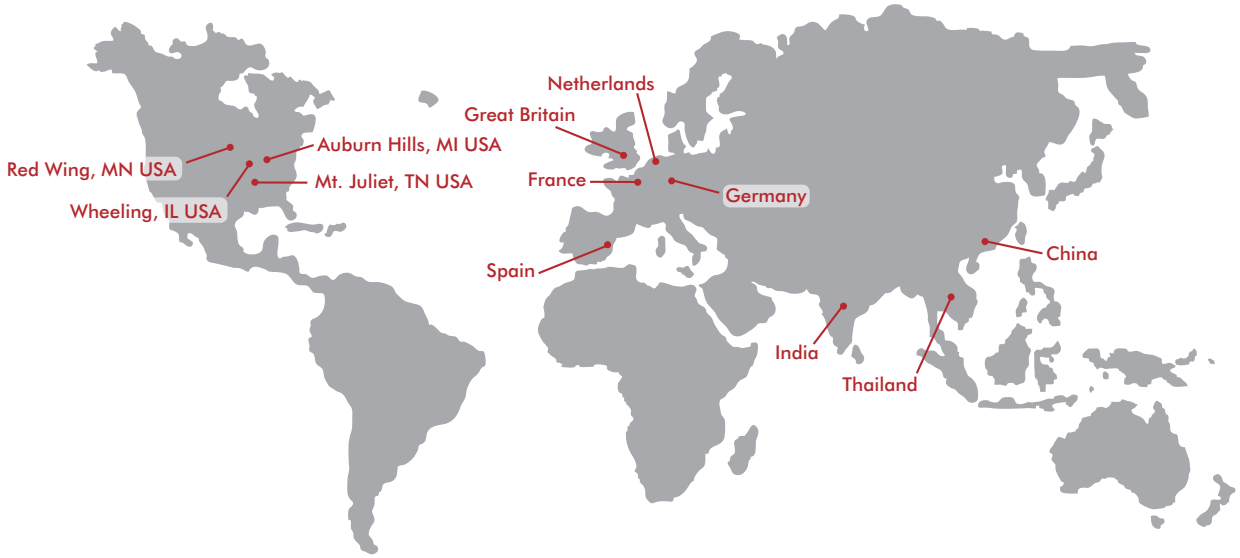


Assembly of Electrical Equipment:



Notes

DESTACO
A STABILUS COMPANY



GLOBAL LOCATIONS

NORTH AMERICA

Corporate Headquarters
Auburn Hills, Michigan
Toll Free: 1.888.DESTACO
Marketing: marketing@destaco.com

Global Technology Center
Auburn Hills, Michigan
Tel: 1.248.836.6700
Customer Service: customerservice@destaco.com

Mt. Juliet, Tennessee
Tel: 1.888.DESTACO
Customer Service: customerservice@destaco.com

Wheeling, Illinois
Tel: 1.800.645.5207
Customer Service: camco@destaco.com

Red Wing, Minnesota (Central Research Laboratories)
Tel: 651.385.2142
Customer Service: sales@centres.com

ASIA

Thailand
Tel: +66-2-326-0812
Customer Service: info@destaco.com

China
Tel: +86-21-6081-2888
Customer Service: china@destaco.com

India
Tel: +91-80-41123421-426
Customer Service: india@destaco.com

EUROPE

Germany
Tel: +49-6171-705-0
Customer Service: europe@destaco.com

France
Tel: +33-4-73545001
Customer Service: france@destaco.com

Great Britain
Tel: +44-1902-797980
Customer Service: uk@destaco.com

Spain
Tel: +34-936361680
Customer Service: spain@destaco.com

Netherlands
Tel: +31-297285332
Customer Service: benelux@destaco.com