

# Design and Installation of Fixed Stands Applied to Vacuum Chambers of Taiwan Photon Source

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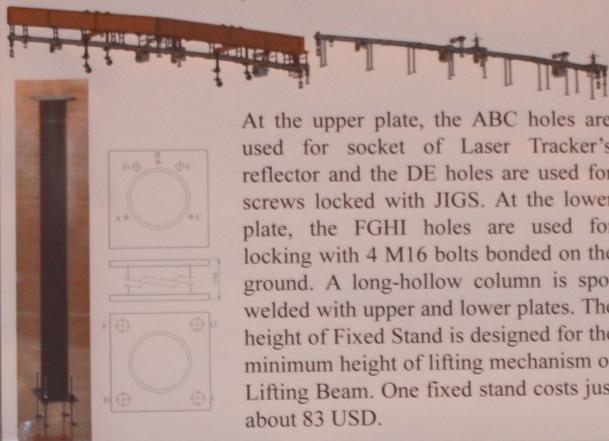
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### Abstract

When vacuum chambers are manufactured, we designed the Fixed Stands to avoid the over-allowable-range deformation of vacuum chambers and to perform the baking test until installing vacuum chamber into the TPS storage ring. Fixed stand is a parsimonious-production and long-hollow-column-type simple part. A set of vacuum chamber uses 17 Fixed Stands. We adjust four nuts in conjunction with four M16 bolts bonded on the ground to reach the accuracy of position of one Fixed Stand and overcome the insufficient ground flatness. A Laser Tracker is employed to the measurement and monitor equipment. The measured data obtained from a Laser Tracker show that precision of the position of Fixed Stands are  $\pm 0.2\text{mm}$  in X and Y axes, respectively, while  $\pm 0.1\text{mm}$  in Z(height) axis, and  $0.044\text{--}0.262\text{mm}$  in straight-line distance. The storage condition of vacuum chamber could be satisfied with Fixed Stands. The cost of a set of Fixed Stands is only about 3000 USD.

### Design of Fixed Stand

A set of finished vacuum chamber will be locked by a system called JIGS and then moved to store zone by a Lifting Beam. Then the vacuum chamber and JIGS will be unloaded on Fixed Stands and only JIGS contacted with Fixed stands.



At the upper plate, the ABC holes are used for socket of Laser Tracker's reflector and the DE holes are used for screws locked with JIGS. At the lower plate, the FGHI holes are used for locking with 4 M16 bolts bonded on the ground. A long-hollow column is spot welded with upper and lower plates. The height of Fixed Stand is designed for the minimum height of lifting mechanism of Lifting Beam. One fixed stand costs just about 83 USD.

### Holes drilling and bolts bonding on the ground

To avoid the drilling deviation and bad hole verticality by handheld drilling machine, the holes drilling could then be performed through a drilling machine added a level and locked on the ground. Bolt bonding process was started with injecting the anchor adhesive in holes. Then adjusting template, putting bolts into holes, waiting 6 hours for concretion, and taking template out.



### Position data of Fixed Stands

The position data of Fixed Stands were checked with theoretical data. Because of the large amount of data is meaningless, so we just show the data of 2 Fixed Stands.

| Vector Name | Begin    |          |      | End        |           |          | Delta  |        |        | Mag.  |
|-------------|----------|----------|------|------------|-----------|----------|--------|--------|--------|-------|
|             | X        | Y        | Z    | X          | Y         | Z        | X      | Y      | Z      |       |
| 1-1         | -17834.3 | 13088.86 | 1245 | -17834.514 | 13088.686 | 1244.978 | -0.184 | -0.174 | -0.022 | 0.254 |
| 1-2         | -17782   | 12999.1  | 1245 | -17781.753 | 12999.008 | 1245.035 | 0.197  | -0.092 | 0.035  | 0.220 |
| 1-3         | -17730.4 | 13089.34 | 1245 | -17730.528 | 13089.486 | 1244.970 | -0.118 | 0.146  | -0.030 | 0.190 |
| 2-1         | -16878.9 | 13157.87 | 1245 | -16879.015 | 13158.045 | 1244.965 | -0.135 | 0.175  | -0.035 | 0.223 |
| 2-2         | -16827.3 | 13248.11 | 1245 | -16827.258 | 13248.220 | 1244.907 | 0.072  | 0.110  | -0.093 | 0.161 |
| 2-3         | -16775   | 13158.35 | 1245 | -16775.056 | 13158.482 | 1244.949 | -0.106 | 0.132  | -0.051 | 0.177 |

The data comparison shows that position accuracies of Fixed-Stands are  $\pm 0.2\text{mm}$  in X and Y axes, respectively,  $\pm 0.1\text{mm}$  in Z(height) axis, and  $0.044\text{--}0.262\text{mm}$  in straight-line distance.

### Installation process

1. Screw the lower nuts down.
2. Put the lower concave and convex washers in.
3. Put the Fixed Stand in.
4. Check the position data of the 3 holes for socket of Laser Tracker's reflector at upper plate instantaneous.
5. Rotate the lower nuts to adjust the Z data to about  $\pm 0.1\text{mm}$ .
6. Adjust the lower plate of Fixed-Stand to make the X and Y data under  $\pm 0.2\text{mm}$ .
7. Put the upper concave and convex washers in.
8. Screw the upper nuts down and just a little bit contact with washers.
9. Use one wrench to fix the lower nuts and use another wrench to screw the upper nuts. Screw  $1/5\text{--}1/4$  circle at one nut then do opposite nut, lateral nut, and opposite nut sequentially 4-6 times until the nuts a little bit tight.
10. Check the position data from Laser Tracker instantaneous and screw the nuts. Adjust the X and Y data in  $\pm 0.2\text{mm}$ , Z in  $\pm 0.1\text{mm}$  by screwing the nuts tight at the same time.



### Conclusions

The storage condition of vacuum chamber could be satisfied with Fixed Stands. The mechanical strength of Fixed Stands is strong enough to make sure vacuum chambers will not deform over allowable range and could be performed baking test. In addition, the cost of a set of Fixed Stands is only about 3000 USD.

