

And then came the next big challenge, the need to convince Toshiba and the earthmoving manufacturer. "It was very difficult in the beginning, because in Japan, they do not have the concept of segmental manufacturing. The segments had to be doweled and bolted without affecting either the accuracy or the rigidity of the fixture. We showed them various projects which we had done by segmenting the component. Only then could we erase their apprehensions," explains Varghese.

With the blueprints ready, it took only six months for them to manufacture the fixture and then the fixture assembly was shipped to Japan for trials in January 2012.

Machining Excellence

Toshiba had initially wanted an integral fixture, but the major part of the challenges were sorted out by agreeing to split the manufacturing process into three segments. However, the next level of difficulty was to manufacture and machine the mild steel fabricated fixture to an accuracy and strength that could hold the weight of the earthmoving components which were to be machined.

"The fixture was so huge that it overhangs the machine bed. So we had to heavily reinforce it, maintaining the centre of gravity of the entire component so that it does not sag under the pressure of the component when it is mounted on the fixture to be machined. The shape of the component was not even and hence, additional care had to be taken. We have used some of the



Reji Varghese,
MD, Forms and Gears

It is a question of confidence. The Indian industry can do such heavy engineering work. Toshiba first came to us for cost, but now after working with us they are confident that the quality of design, manufacture and workmanship is on par with international standards.

Why Japan came to India?

With over 40 years of fixture building experience, Forms and Gears is the oldest and the largest fixture builder in India. As fixtures still form the weak link in Indian manufacturing, and with not many companies specialising in fixtures, India does not really form a dream destination for fixture building. However, Toshiba's decision to choose India for the project had two reasons.

The first being cost. While China is 'the' cost effective destination for mass production, a custom built project would have been an expensive affair there. India, on the other hand, with its capabilities, could bring down the cost by 1/3rd compared to costs in Japan, the US or Germany, and significantly lower than what China offers. At the same time, India also provided an equal level of quality and precision as offered by other countries.

"While finalising a company in India, Forms and Gears, with its long experience in making multiple huge fixtures in the past, their design capabilities and most importantly their calibrated in-house fixture building and tool room facilities, gave us the confidence to entrust them with the project. They proved our decision was right when the trials of the fixture ran successfully," says K Balanagendrarao, Director, Flexspeed Technology (India) Pvt Ltd (authorised Agent for Toshiba Machines Co Ltd).

Forms and Gears boasts about its complete in-house facilities, right from designing & manufacturing, to inspection and finishing.



K Balanagendrarao,
Director, Flexspeed
Technology (India)
Pvt Ltd

As the trials were performed without any glitches, we were proud of our decision to come to India for the project.

latest simulation technologies to create a virtual prototype of the component," informs Edwin Dayanand, GM - Design, Forms and Gears.

The three segmental bases had to be accurately doweled and bolted with high precision to hold the segments firmly. Handling a huge component, especially changing its positions while machining, is a bigger challenge. Hence, given the size of the earthmoving equipment parts which were to be machined, Toshiba planned to incorporate a feature in the machine so that machining does not require the component to be moved at all.

"The entire machining of the component from six sides is done on a single machine in a single setting. The component remains in its position without being moved. Hence, the fixture plays a very important part because a clamp cannot be placed where machining is happening, but none-the-less, the area has to be rigid enough to withstand the vibrations caused by high cutting forces. So we had to design it in a way so that clamps do not hamper the machining process, but at the same time provide adequate support for maximum hold the component," avers Varghese.

The hydraulic fixture has been designed and manufactured with various such intricacies involving 350 bar high pressure hydraulics, sequential clamping, use of advanced hydraulic work supports, vibration dampners, use of adjustable clamping pressures on the clamping cylinders so that the clamping force could either be increased or decreased during cutting trials or at a later stage, offline pressure drop sensing, etc.