

## TECHNICAL BULLETIN RE SIDE TIPPERS vs FIFTH WHEEL

The popularity of the side tipper is increasing rapidly. Safety regulations, stricter legislation and enforcement and favourable tare vs payload ratios created a lucrative market for the side-tipping semi-trailer.

Many a trailer OEM representative visited countries abroad to gather insight into the design of side tippers. These designs were then “adapted” to suit the South African market with the aim to replace end tipping semi-trailers which, although extremely sturdy and reliable, created problems regarding stability in extreme off-road conditions and tare vs payload ratios (“legal” payloads).

Then the “**forgotten**” component came into play. Truck tractors were sold with no thought given to the fifth wheel and the effects a side-tipping semi-trailer has on it. With this brief we will try to explain exactly that.

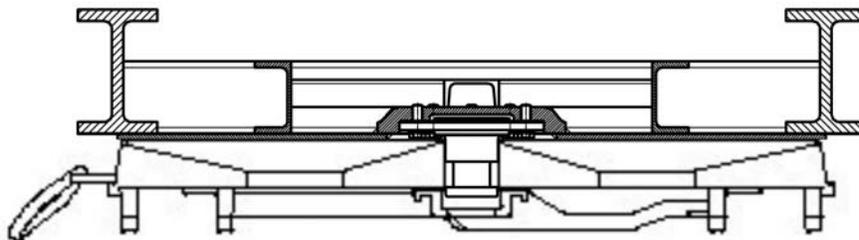
To bring the situation into context: In Australia (where a large population of side-tipping semi-trailers is operating) it is common practice to use JOST JSK50 fifth wheels with a 3 ½” kingpin. This type of fifth wheel has an imposed load rating of 50 000kg with a D-value of 300kN.

The selection of the JSK50 for this type of operation in Australia is not a result of a high imposed load or D-value rating being required, but can be directly attributed to the **upward jerking forces** that acts in on the fifth wheel during the tipping cycle.

Keeping in mind that ALL fifth wheels worldwide are designed to, when coupled to a kingpin, act as the primary link between the prime mover and a semi-trailer or combination (in cases where more than one semi-trailer is coupled). This connection is then required to keep this combination locked together during travelling, stopping or pulling off, i.e. **cope with forces acting in on it in the direction of travel** (commonly referred to as the D-value rating of the fifth wheel).

In our local market a JOST JSK37C or JSK36C with a 2” kingpin is typically used in side-tipping applications. These types of fifth wheels have an imposed load rating of 20 000kg and a D-value of 152kN. Although these types of fifth wheels are more than adequate for most transport applications, careful consideration should be given when specifying fifth wheels for side tipping operations. The initial cost of the fifth wheel should not be the overriding factor during the selection process.

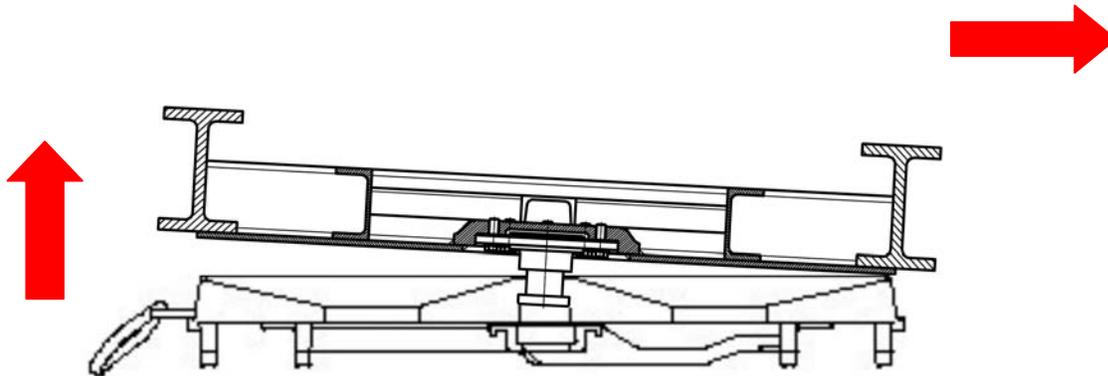
### DURING NORMAL TRAVELING



During normal travelling the kingpin is securely locked in position by the lockjaw of the fifth wheel. The lockjaw (provided the kingpin installation height is correct) does not come into contact with either the top or bottom flange of the kingpin.

The imposed load on the fifth wheel is evenly distributed over the entire load bearing area of the fifth wheel and both pedestals carry an even load, allowing the upper rubber cushions to effectively dampen the shock loads, thus protecting the prime mover's drive train and chassis, as well as the chassis of the semi-trailer.

## DURING THE TIPPING CYCLE



During the tipping cycle of a side-tipping semi-trailer the centre point of gravity of the load and bin is shifted from the centre-line of the combination to an off centre position while the bin of the side-tipping semi-trailer is rotated through a sufficient angle to discharge the load (normally to the right).

This action results in the right hand side of the fifth wheel acting as a fulcrum for the rubbing plate and the left hand side of the rubbing plate and the kingpin is pulled upwards. The bottom flange of the kingpin in turn forces the lockjaw upwards against the bottom of the top plate, resulting in excessive upwards bending moment acting in on the top plate. This bending moment acts in on the opposite direction of the rubbing plate, bending it downwards.

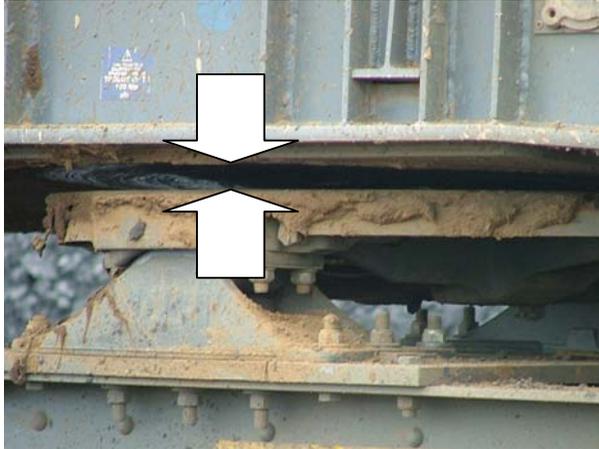
This condition is further exaggerated when the loading bin “free falls” during the last portion of the tipping cycle, resulting in an upwards and downwards jerking force acting in on the fifth wheel top plate and rubbing plate respectively.

The entire load on the top plate of the fifth wheel is now concentrated on the right hand side of the fifth wheel, greatly exceeding the imposed load rating of the 2” fifth wheel. This results in the upper rubber cushion on this side of the fifth wheel being compressed far beyond the allowable limit, causing premature rubber fatigue and failure.

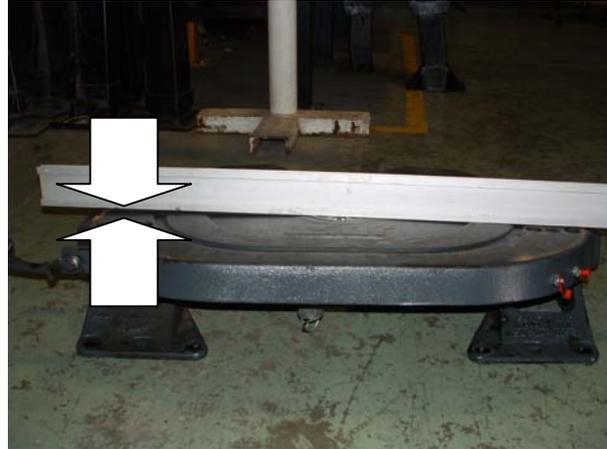
Eventually the fifth wheel top plate and the rubbing plate of the semi-trailer are permanently deformed upwards and downwards respectively. This condition results in point loadings acting in on the fifth wheel during normal travelling. These point loadings increase dramatically when travelling on off-road conditions and results in metal fatigue and cracking of the top plate.

The same results are evident when used semi-trailers with convexly bent rubbing plates are coupled to new fifth wheels.

## PHOTOGRAPHS ILLUSTRATING THE EFFECTS OF A SIDE TIPPER



Air gap between rubbing plate and top plate



Convexly bent top plate

## SO WHERE TO FROM HERE?

It appears that **side-tipping semi-trailers are here to stay**. So, apart from the ideal situation to incorporate expensive “outriggers” in the design of the side tipping semi-trailers, which will not allow tipping in motion, what is the alternative?

We have been involved in several investigations regarding side-tipping semi-trailers. Based on our findings we have strongly advised the use of JOST JSK38C fifth wheels for these operations. Operators who have accepted and applied our recommendations have been using the JOST JSK38C fifth wheels for periods between 18 to 24 months with no fifth wheel failures, even under extremely arduous operating conditions.

We need to point out that, even when fitting a JOST JSK38C fifth wheel; a **sound maintenance program must be implemented** to ensure an extended life span of the fifth wheel. This will also ensure that the fifth wheel provides the protection required for both prime mover and side-tipping semi-trailer under the arduous operating conditions typical of the side-tipping industry.

To optimise the durability and safety of this type of fifth wheel, we would further recommend that a 3 ½” kingpin be fitted to the side-tipper as we have found that the bottom flanges of several 2” kingpins have sheared off as a result of the upward forces acting in on it, resulting in a roll-over of the semi-trailer.

This configuration will provide for an imposed load rating of 36 000kg and a D-value of 260kN. Should the load then be transferred one side of the fifth wheel only, the upper rubber cushion and top plate of the fifth wheel are far better suited to cope with the excessive forces.

Attached please see a comparison between dimensions of the rubber cushions of the JSK38C fifth wheel and those of the JSK36C and JSK37C fifth wheels (please note that the rubber cushions used for the JSK37C and JSK36C fifth wheels are identical).



Although the initial purchase price of the JOST JSK38C fifth wheel is more expensive, the **total cost of ownership (CPK)** of the JOST JSK38C fifth wheel will be considerably lower than those of other fifth wheels. Operators that have fitted JOST JSK38C fifth wheels found the life span of the fifth wheel to be four to five times that of 2" fifth wheels.

## TO SUMMARISE

For side tipping operations and, depending upon specific operating conditions, we strongly recommend the following: -

- ✓ Fitting of JOST JSK38C fifth wheels as opposed to JSK37C or JSK36C fifth wheel
- ✓ To optimise the fifth wheel and kingpin configuration, 3 ½" kingpins should be fitted to the side-tipping semi-trailer
- ✓ Continual monitoring of high wear components and rubber cushions
- ✓ Implementation of a sound maintenance program to suit the specific operation
- ✓ Implementation of proper lubricating procedures and ensuring that the correct grease is used when lubricating (EP<sub>2</sub> grease with graphite additive)

Should you require any assistance with the abovementioned, please do not hesitate to contact us. We will gladly assist to ensure that you obtain maximum benefit from our ranges of products.