BRITISH STEEL

TOPHAT SHAFT GUIDES

Why choose tophats from British Steel?

BUILDING STRONGER FUTURES

2019

Tophat shaft guides from British Steel

For a modern mine hoisting operation, mine operators are looking for 3 key attributes:

- High productivity and minimal downtime
- Ease and speed of installation and maintenance
- Durability and long-service life in a potentially highly-corrosive environment

The tophat shaft guide from British Steel addresses all three of these points, comparing favourably to hollow section guides and rope guides.

Productivity

In a study commissioned by British Steel the 305x102mm 55kg/m tophat guide was compared to a 150x150x10mm square hollow section (SHS) guide (both grade S355JR). There are two key attributes that were considered in typical operating conditions shown in Table 1.

These are:

- Steelwork stiffness ratio e.g. the ratio between the stiffness at the guide's midspan and at the bunton. In an ideal scenario, a stiff guide with flexible buntons is considered the optimum for efficient hoisting. Values of three or less generally give superior performance
- Rebound velocity ratio, which is a measure of the likelihood of sustained slamming of the conveyance during the hoisting. This situation is undesirable and puts strain on the winder equipment. A value less than 2 is required to minimise this issue

Table 1. Typical operating conditions for study

Bunton spacing	4.5m
Bunton stiffness	15,000kN/m
Guide misalignment	20mm

The key results are shown below in Table 2 and while both guides give acceptable performance, the tophat has superior performance and resistance to slamming in most cases.

Table 2. Guide performance

Guide type	SHS 150x150x10	Tophat 150
Ixx (cm^4)	1773	2815
Stiffness (kN/m) 4.5M support	3514	5579
Rebound velocity ratio (<2.0)	1.4	1.27
Stiffness ratio	4.77	3.19

Installation and maintenance

Tophat guides

Tophat guides offer several benefits for the shaft steelwork installers in that the shape is open, offering access to both sides during installation and allowing use of Huck Powerbolt fixings. Tolerances on shape and twist are excellent on these guides at <3mm max in a 12m length – well within the capabilities of a Powerbolt to eliminate during installation. In addition straightness is guaranteed at 5mm in 12m maximum.

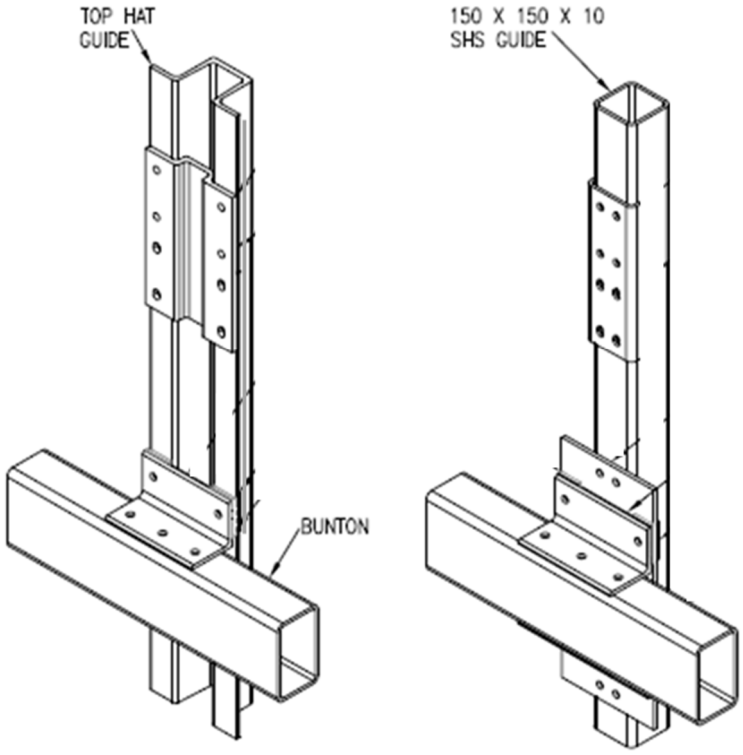
SHS guides

For SHS equivalent guides, only single-sided access is possible unless additional welding of connector plates is used. This adds fabrication time and cost unless single-sided BOM bolts are used. Twist in SHS can be problematic and difficult to remove, further adding to the installation time and cost while reducing the service efficiency of the guide.

Rope guides

Rope guides offer a fast route to the early production of material and can seem an attractive choice during the initial capital-intensive stage of the project. However, the reduction of speed required as rope-guided conveyances enter the stage area can reduce the capacity of the hoist. The mine should budget for a rope change around every 10 years, whereas a tophat guide system generally operates for 25-30 years plus, without much more than routine maintenance.

Figure 1. Tophat and SHS guide arrangements



Durability and service life

Shaft steelwork is known to deteriorate with depth (Krige and Blitenthall: Hoist and Haul 2010). Metallurgically, there are several reasons for this:

- Ambient temperatures are higher
- There's a larger quantity of oxygenated or acidified water
- Frequency of inspection is more difficult in a live shaft
- Buntons suffer greater exposure to water at shaft wall connection and from falling damp ore material that accumulates on the top surface
- Running surfaces will have some protection from greases and other substances but inside surfaces, especially of SHS guides, are hidden and can't be inspected
- Corrosive blast gases can affect steel to a certain degree in exposed areas
- Rear surface can be less accessible to inspections during constrained maintenance times

The open rear of a tophat guide allows for visual inspections to take place, which isn't possible with SHS guides, making internal condition unknown. This is particularly problematic when guide misalignment allows falling ore material to ingress over time. In addition to the design, the steel thickness of a tophat at 13-18mm offers significantly more corrosion tolerance than a 10mm SHS guide.

Overall the tophat guide provides a high capacity hoisting system with improved longevity in service compared to other guide systems. More details can be found at: https://britishsteel.co.uk/what-we-do/special-profiles/mining/.