KAISER

TECHNICAL MARKETING CC

INTRODUCTION TO SAFETY & LOAD WASHERS

082 897 1917 / 011 708 3464

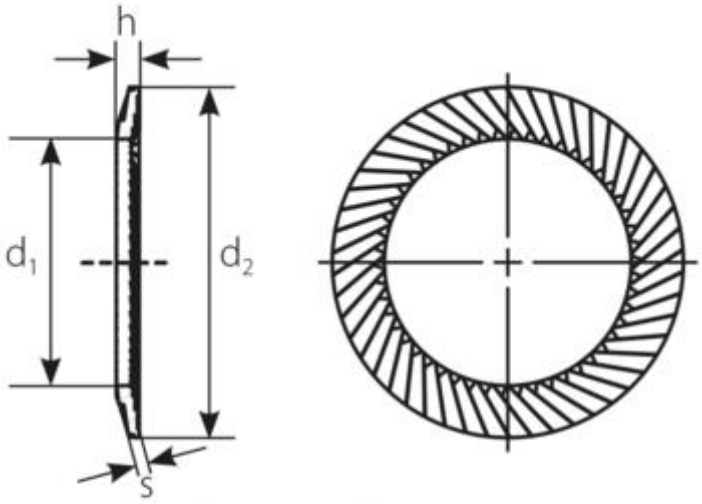
kaiser.tm@mweb.co.za | www.kaisertm.co.za

Introduction to Schnorr® Safety washers :

Often disc springs are considered for use as safety washers for bolted connections, for preloading- or preventing loosening of the connection. The economic viability is not great and standard sizes of disc springs do not match bolt or screw sizes.

Thus Schnorr®developed a reliable and economically viable bolt locking system based on the principle of the disc spring.

These patented safety washers are in the form of a disc spring which is serrated on both sides with trapezoidal cross section. The diameters match screw dimensions:
The outer diameter matches the head diameter of the pan screw and hexagon head cap screws. Thus the safety washers can be used with most screw- or bolt types, one exception being counter-sunk screws.



Designation of an original SCHNORR® Safety Washer type „S“:

d_1 = Inner diameter
d_2 = Outer diameter
s = Thickness
h_{max} = Maximum dimension as delivered
h_{min} = Minimum dimension after load test

Advantages of Schnorr® Safety washers :

1. High resistance to vibration due to positive locking of serrations.
2. The closed ring form results in a high degree of pre-tensioning, while avoiding burst-open effect.
3. Concentric application of force eliminates bending of the bolts
4. The serration design prevents friction and damage when tightening.
5. High safety against loss of pretension force and loosening.
6. Can be made available in a variety of materials and finishes
7. The closed ring form results in high degree of pre-tensioning, while avoiding burst-open effect.
8. Development and design of the washers take place on the basis of the screw geometrics, tightening torque as well as the constructive circumstances.
9. Also applicable for clearance holes (safety washer is necessary on both sides).
10. Applicable for elongated holes (using type VS).

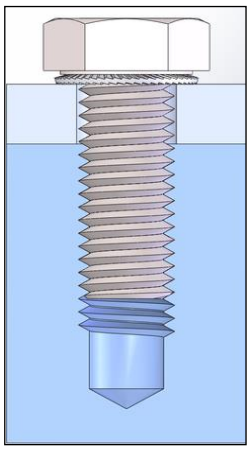
Types of Schnorr® Safety washers:

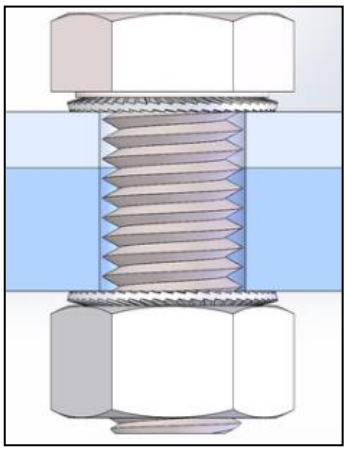
Available are 2 types of safety washers: “S” and “VS”

1) “S”:
   - normal duty
   - Screw sizes M1.6 to M36
2) “VS” :
   - reinforced safety washer
   - Is thicker
   - Achieves higher pre-tensioning loads
   - Screw sizes M5 to M30

Correct use of Schnorr® Safety washers:

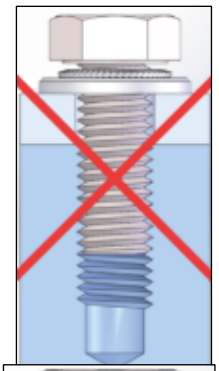
The Original SCHNORR® Safety Washer is only able to obtain its full effectiveness as a bolt locking device if it is used correctly.



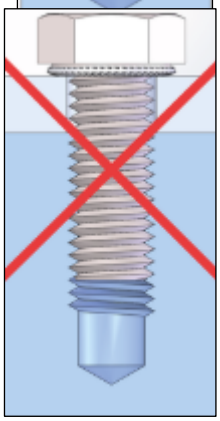


To obtain the maximum locking effect of the Original SCHNORR® Safety Washers when fastening at bulkheads, the screw head as well as the bolt nut must be fastened in conjunction with a safety washer.

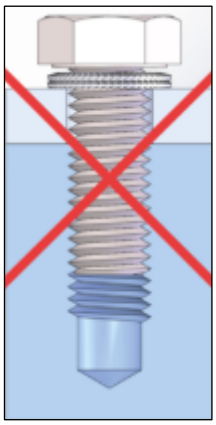
Incorrect use of Schnorr® Safety washers:



To obtain the maximum locking effect of the Original SCHNORR® Safety Washers, we recommend **not** using them in combination with a flat washer.



To obtain the maximum locking effect of the Original SCHNORR® Safety Washers we recommend to **not**use them up-side down.



To obtain the maximum locking effect of the Original SCHNORR® Safety Washers, we recommend **not** stacking them.

Tightening torques for Schnorr® Safety washers

Ref size	Tightening Torque (Nm)		
	Strength Grade		
	8.8	**10.9**	**12.9**
M4	3.6	5.3	6.2
M5	7.2	10.5	12.3
M6	12.4	18.2	21.2
M7	20.6	30.3	35.4
M8	30.0	44.1	51.6
M10	59.4	86.9	102.3
M12	102.3	150.7	176.0
M14	162.8	239.8	280.5
M16	253.0	371.8	434.5
M18	361.9	515.9	603.9
M20	510.4	727.1	850.3
M22	697.4	994.4	1162.7
M24	877.8	1249.6	1461.9
M27	1293.6	1841.4	2154.9
M30	1756.7	2501.4	2928.2
M33	2377.1	3385.8	3961.1
M36	3055.8	4352.7	5094.1
All data are approximate values and non-binding.			

The table above is valid for:

Shank bolts with metric standard thread in accordance with DIN ISO 262

- Head dimensions of hexagonal bolts in accordance with DIN EN ISO 4014 to 4018
- Hexalobular external driving head bolts in accordance with DIN 34800
- Cylindrical bolts in accordance with DIN EN ISO 4762 and hole medium in accordance with DIN EN 20273

To reach the same initial force when using Schnorr® Safety washer type “S”, the initial torque has to be higher (+10%) than for a bolt without a securing device.

The same applies for Schnorr® Safety washer type “VS”.

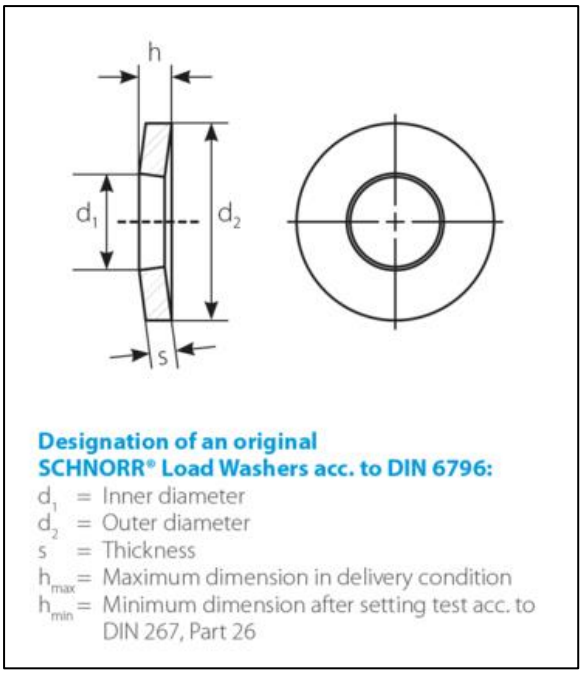
Introduction to Schnorr®Load washers :

A “load washer” is in the form of a disc spring achieving its locking effect solely by means of the frictional connection. Load washers are intended for use in compensating for loosening of the screwed connection, by maintaining sufficiently high pretension in the connection with spring force.

Load washers are especially suitable for primarily axially loaded, short bolts. They provide no effective security against unscrewing caused by alternating lateral loading.

Load washers were developed for high strength bolts. High loads require large cross-sections, which is why the outside diameter of a load washer is larger than that of a safety washer.

As a highly progressive load increase occurs at the end of the spring deflection, when the load washer is flattened, the load has been indicated as double the calculated value. Tests have shown that these values are comparable with the measured values.



Designation of an original SCHNORR® Load Washers acc. to DIN 6796:

d_1 = Inner diameter
d_2 = Outer diameter
s = Thickness
h_{max} = Maximum dimension in delivery condition
h_{min} = Minimum dimension after setting test acc. to DIN 267, Part 26

Contact force: Contact forces for the setting test according to DIN 267 Part 26.
Min. residual spring load: Spring load which rests after load with the contact pressure acc. to DIN 267 Part 26 and subsequent relieving of 20 ϕm.

Advantages of Load washers :

1. High axial load
2. Optimum compensation for setting in the joint
3. Reduction of the dynamic loading of the screw
4. Uniform concentric loading eliminates bending of the bolt
5. Greater safety with high degree of spring action
6. Suitable for captive fitting on a wide range of bolts (combi bolts)

Standards:

Schnorr® load washers conform to DIN 6796.

Schnorr® HS-Washers :

In principle, the HS washer is a load washer with a smaller outer diameter than those according to DIN 6796.

The slightly curved form provides a progressively increasing characteristic curve, which makes it possible to achieve the same load as the load washers according to DIN 6796.

HS –Washers are primarily used when there is insufficient space available to use the standard load washers.