



Assessment report

The Indicative Fire Resistance Performance Of Previously Fire Tested Doorsets Fitted With SOSS Concealed Hinges

Hinge models	216F, 218F, 220F, 216H/SHH416, 218H/SHH418, 220H/SHH220AS, 416, 418, 420, 220AS, 416SS, 418SS, 420SS, 220SS, 216FIC, 218FIC, 220FIC, 416IC, 418IC, 220ASIC, 416SSIC, 418SSIC, 220SSIC
Applicant	SOSS Asia Pte Ltd, 6 Third Chin Bee Road Singapore, 618682
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Quality management

Historic revision status

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6/04/09	23487-00	Initial Issue
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22/5/14	23487-02	Review of the technical content of the report to extend its validity for a period of five years
13/6/14	23487-03	Increased scope of application for 60 minutes
4/8/14	23847-04	Amended hinge model numbers. Addition of 218 spring closer
12/5/15	23847-05	Increased scope of application to include further spring closer models
19/6/17	23847-06	Increased scope of application to include SOSS Hercules Hinge models SHH418 and SHH220AS. Reference to BS EN 1634-1
19/6/19	23487-07	Increased scope of application to include the SOSS Hercules Hinge model SHH416, and hinge model reference numbers. Review of the technical content of this report in order to extend its validity for a further period of 5 years

Issue	Validity	Report scope and Signatures	
08	From: 15/8/2024	Content of previous report 23487-07 presented in an updated format. Review of the technical content of this report in order to extend its validity for a further period of 5 years.	
	Expiry: 31/08/2029	Prepared by	Reviewed and Authorised by
		S Kettle	A Joquino
			

Executive summary

This report presents an assessment of the necessary conditions to support the fitting of SOSS concealed hinge models to replace butt hinges as originally fitted to previously fire tested doorsets.

This assessment report is supported by reference to the PFPF Guide and Declaration in Sections 1 and 2 of this report.

This report is subject to the validity statements and limitations, and general constructional requirements described in Sections 3 and 4, respectively.

Section 5 of this report describes the proposed modifications and any necessary conditions and requirements in the Proposal, and the technical considerations are presented in the Discussion.

Section 6 of this report:

- relates to target doorsets supported by fire test evidence with respect to either BS 476-22:1987 or, BS EN 1634-1, and the achieved integrity performances of the target doorsets indicated in the fire test reports
- and,
- concludes that if target doorsets had been modified as described in Section 5 of this report, it is expected that indicative integrity performances of up to 240 minutes would have been maintained coincident with the proposed SOSS hinge models.

Supporting technical data provided by the Applicant is summarised in Section 7.

This report is invalidated if applied in combination with any other assessment not described in Section 5.

Acceptance of this assessment report is at the discretion of the relevant building authorities.

All information relating to this report is retained under internal file reference 240037.

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1. Introduction

An assessment is an opinion of the likely performance of a component or element of structure if it was subjected to a standard fire test.

This assessment report has adopted the procedures of the 'Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence' prepared by the Passive Fire Protection Forum (PFPF)¹.

The PFPF guide provides a framework for undertaking assessments in the absence of specific fire test results. Some areas where assessments may be offered are:

- Where a modification is made to a construction design that has already been tested.
- The interpolation or extrapolation of results of a series of fire resistance tests or utilisation of a series of fire test results to evaluate a range of variables in a construction design or a product.
- Where, for various reasons such size or configuration, it is not possible to subject a construction or a product to a fire test.

Assessments will vary from relatively simple judgements on small changes to a product or construction through to detailed and often complex engineering assessments of large or sophisticated constructions.

Established empirical methods and experience of fire testing similar products have been used in this assessment to extend the scope of application by determining the limits for the design based on the tested constructions and performances obtained.

This assessment has been written using test evidence generated at accredited laboratories to the relevant test standard. The supporting test evidence has been reviewed and found to be appropriate to support the manufacturer's proposed design(s).

2. Declaration by the Applicant: SOSS Asia Pte Ltd

The PFPF 'Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence' requires a declaration by the Applicant, SOSS Asia Pte Ltd.

By accepting and signing the fee proposal relating to this assessment, and by subsequently distributing copies of this assessment, the Applicant confirms that:

- To their knowledge, the component or element of structure, which is the subject of this assessment, has not been subjected to a fire test to the standard against which this assessment is being made.
- They agree to withdraw this assessment from circulation if the component or element of structure is the subject of a fire test in accordance with the standard against which this assessment is being made, and the results are not in agreement with this assessment.
- They are not aware of any information that could adversely affect the conclusions of this assessment and – if they subsequently become aware of any such information – they agree to ask the assessing authority to withdraw the assessment.
- They have obtained appropriate permission to use all third party data provided in support of this assessment.

¹ Passive Fire Protection Forum (PFPF), 2021, Guide to undertaking technical assessments of the fire performance of construction products based on fire test evidence, Passive Fire Protection Forum (PFPF), UK.

3. Validity and limitations

This assessment report:

- has been prepared based on information provided by the Applicant
- does not provide an endorsement by Warringtonfire of actual products supplied
- may be used to directly assess fire hazard under a nominated regime, but it should be recognised that a single test method will not provide a full assessment of fire hazard under all conditions
- only relates to the actual prototype test specimens, testing conditions and methodology described in the supporting data, and does not imply any performance abilities of constructions of subsequent manufacture
- is based on information and experience available at the time of preparation; the published procedures for the conduct of tests and the assessment of test results are the subject of constant review and improvement and it is recommended that this report be reviewed on or, before, the stated expiry date
- is limited to assessments of the variations to the tested systems as described in Section 5, and shall not be used for any other purpose
- is invalidated if applied in combination with any other assessment or prescription not described in Section 5.
- is valid provided only if no additional modifications are made to the systems detailed in this report; details of construction shall be consistent with the requirements stated in the relevant test reports and all referenced documents
- is valid only if accompanied by full copies of the indicated supporting data summarised in Section 7
- is invalidated if contradictory test evidence becomes available, in which case the assessment will be unconditionally withdrawn and the Applicant will be notified in writing
- is invalidated if the assessed construction is subsequently tested because actual test data takes precedence over an expressed opinion.

Because of the nature of fire testing, and the consequent difficulty in quantifying the uncertainty of measurement, it is not possible to provide a stated degree of accuracy. The inherent variability in test procedures, materials and methods of construction, and installation may lead to variations in performance between elements of nominally similar construction.

Warringtonfire has not verified that every aspect of the assessed constructions complies with relevant building codes or standards.

Any changes with respect to size, construction details, loads, stresses, edge or end conditions other than those identified in this report may invalidate this assessment.

Any figures included in this report are provided for illustrative purposes only and may not reflect the latest design drawings.

When several modifications might apply to the system under assessment, incompatible combinations of modifications will be identified and excluded from the assessment.

Warringtonfire has not verified the accuracy or completeness of information provided by the Applicant and will not be responsible for any errors or omissions that might be incorporated into this report as a result.

This assessment applies only to modified systems constructed in a similar manner from materials and components of the same manufacture and specifications as originally tested or, as otherwise assessed by Warringtonfire.

4. Constructional specifications

This assessment applies only to doorsets:

- fixed into supporting construction of brickwork, concrete blocks, or reinforced concrete having shown by fire testing to be capable of supporting doorsets for the required periods of up to 240 minutes, as appropriate
- constructed in a similar manner from materials and components of the same manufacture as tested or, as otherwise assessed by Warringtonfire.

5. Assessments

5.1 SOSS hinges fitted to previously fire tested doorsets

5.1.1 Proposal

It is proposed that SOSS concealed hinge models and concealed hinges with integral closers of completely non-combustible construction may replace butt hinges as originally fitted to target doorsets that have been previously fire tested as latched assemblies, subject to the following conditions and limitations described in 5.1.1.1 – 5.1.1.6.

5.1.1.1 All SOSS hinge applications

- The maximum leaf edge clearance gap shall be 3mm.
- Target doorsets shall have been fire tested in accordance with either BS 476-22:1987 or, BS EN 1634-1 no more than 20 years ago.
- Target doorsets shall have been fire tested with either a concealed door closer, a mortice latch, concealed hinges or, other ironmongery having:
 - a mortice at least as wide the proposed SOSS hinge (Dimension A as shown in Figure 1)
 - forend dimensions (Dimensions A and C as shown in Figure 1) larger than the proposed SOSS hinge.
- The number and location of SOSS hinges shall replicate the number and locations of the butt hinges described in the fire test report supporting the target doorset.
- SOSS hinges shall be capable of supporting the weight of the door leaf. If necessary, additional SOSS hinges may be fitted providing the distance between hinge centres is at least 300mm.
- SOSS closer hinges shall be capable of closing the target leaf from any angle in a controlled manner to overcome the latch.
- Adjustable versions of the proposed hinge models may be fitted. When fitted to timber substrates, all voids at the edges of the hinges shall be filled with intumescent sealant after final adjustment.
- For timber and timber composite target doorsets, the frame and leaf hinge components including spring mechanisms shall be mortised into continuously solid construction. If the hinge mortices coincide with leaf or frame voids, then local reinforcements of solid material shall be provided similar to the material of the adjacent frame, leaf core or, leaf framing
- If the supporting test evidence for the target doorsets describes the use of additional intumescent protection at hinge positions, the intumescent protection shall be reproduced and applied in combination with the intumescent materials described below.

5.1.1.2 Timber and timber composite latched doorsets having leaves at least 44mm thick

Performance: 30 minutes integrity

Hinge models: 216F, 218F, 416, 418, 416SS, 418SS, 216H/SHH416, 218H/SHH418

Hinge models with integral closers: 216FIC, 218FIC, 416IC, 418IC, 416SSIC, 418SSIC

- Target door leaves shall be at least 44mm thick.
- The mortices for all hinge components in the door frame and the leaf edge, including the extended mortice for spring closer mechanisms, shall be fully lined with Lorient intumescent sheet material or intumescent at least 2mm thick.
- Timber leaf edge lippings shall have an absolute minimum density of 650kg/m³ or, the density indicated in the fire test data supporting the target doorset, whichever density is greater.

- Timber stiles at the hanging edges of leaves shall be solid timber having an absolute minimum density of 450kg/m³, or timber-based material having an absolute minimum density of 650kg/m³ or, the density indicated in the fire test data supporting the target doorset, whichever density is greater.
- Timber door frames shall have an absolute minimum density of 450kg/m³ or, the density indicated in the fire test data supporting the target doorset, whichever density is greater.

5.1.1.3 Timber composite doorsets, leaves at least 50mm thick with mineral board sub-facings **Performance: 30 minutes integrity**

Hinge models: 216F, 218F, 220F, 416, 418, 420, 220AS, 220SS, 416SS, 418SS, 420SS, 216H/SHH416, 218H/SHH418, 220H/SHH220AS

Hinge models with integral closers: 216FIC, 218FIC, 220FIC 416IC, 418IC, 220ASIC, 416SSIC, 418SSIC, 220SSIC

- Target door leaves shall be at least 50mm thick and include a continuous core of at least 39mm thick between calcium silicate board sub-facings of at least 3mm thick
- The mortices for all hinge components in the door frame and the leaf edge, including the extended mortice for spring closer mechanisms, shall be fully lined with Lorient intumescent sheet material or intumescent sealant at least 2mm thick.
- Timber leaf edge lippings shall not exceed 5mm thick with an absolute minimum density of 650kg/m³.
- Timber stiles at the hanging edges of leaves shall be solid timber having an absolute minimum density of 450kg/m³, or timber-based material having an absolute minimum density of 650kg/m³ or, the density indicated in the fire test data supporting the target doorset, whichever density value is greater.
- Timber door frames shall have an absolute minimum density of 450kg/m³ or, the density indicated in the fire test data supporting the target doorset, whichever density value is greater.
- For 220F, 420SS, 220SS, 220AS and 220FIC models, there shall be additional lengths of intumescent seal of at least 5mm wide by 150mm long adjacent to the hinge positions fitted in either the leaf edge or frame rebate; the additional seals shall be similar to the seals as originally tested on the target doorset.

5.1.1.4 Timber based doorsets with flaxboard leaves at least 54mm thick

Performance: 60 minutes integrity

Hinge models: 416, 418, 416SS, 418SS, 216H/SHH416, 218H/SHH418

Hinge models with integral closers: 416IC, 418IC, 416SSIC, 418SSIC

- Door leaves shall be at least 54mm thick and the field area of the leaf within the framing members shall include a flaxboard core of at least 48mm thick.
- The mortices for all hinge components in the door frame and the leaf edge, including the extended mortice for spring closer mechanisms, shall be fully lined with Lorient intumescent sheet material or intumescent sealant at least 2mm thick.
- Timber leaf edge lippings shall have an absolute minimum density of 650kg/m³ or, the density indicated in the fire test data supporting the target doorset, whichever density value is greater
- Timber stiles at the hanging edges of leaves shall be solid timber or timber-based material having an absolute minimum density of 650kg/m³ or, the density indicated in the fire test data supporting the target doorset, whichever density is greater.
- Timber door frames shall have an absolute minimum density of 650kg/m³ or, the density indicated in the fire test data supporting the target doorset, whichever density value is greater.
- There shall be additional lengths of intumescent seal of at least 10mm wide by 150mm long adjacent to the hinge positions fitted in either the leaf edge or frame rebate; the additional seals shall be similar to the seals as originally tested on the target doorset.

5.1.1.5 Timber composite doorsets having leaves at least 54mm thick with mineral board sub-facings

Performance: 60 minutes integrity

Hinge models: 416, 418, 420, 220AS, 220SS, 416SS, 418SS, 420SS, 216H/SHH416, 218H/SHH418, 220H/SHH220AS

Hinge models with integral closers: 416IC, 418IC, 220ASIC, 416SSIC, 418SSIC, 220SSIC

- Target door leaves shall be at least 54mm thick and include a core of at least 39mm thick between calcium silicate board sub-facings of at least 5mm thick.
- The mortices for all hinge components in the door frame and the leaf edge, including the extended mortice for spring closer mechanisms, shall be fully lined with Lorient intumescent sheet material or intumescent sealant at least 2mm thick.
- Timber leaf edge lippings shall not exceed 5mm thick with an absolute minimum density of 650kg/m³ or, the density indicated in the fire test data supporting the target doorset, whichever density value is greater.
- Timber stiles at the hanging edges of leaves shall be solid timber or timber-based material having an absolute minimum density of 650kg/m³ or, the density indicated in the fire test data supporting the target doorset, whichever density value is greater.
- Timber door frames shall have an absolute minimum density of 650kg/m³ or, the density indicated in the fire test data supporting the target doorset, whichever density value is greater.
- There shall be additional lengths of intumescent seal of at least 10mm wide by 150mm long adjacent to the hinge positions fitted in either the leaf edge or frame rebate; the additional seals shall be similar to the seals as originally tested on the target doorset.

5.1.1.6 Full steel doorsets with hollow or mineral cores

Performance: up to 240 minutes integrity

Hinge models: 416, 418, 420, 220AS, 220SS, 416SS, 418SS, 420SS, 216H/SHH416, 218H/SHH418, 220H/SHH220AS

Hinge models with integral closers: 416IC, 418IC, 220ASIC, 416SSIC, 418SSIC, 220SSIC

- The hinge components may be screw or weld fixed in position.

The scope of this report is summarised in Table 1.

For information, the proposed hinge models are illustrated in Figures 1 to 10.

In all other respects, doorsets shall be as tested or, as assessed by Warringtonfire.

5.1.2 Discussion

General

The supporting tests data is provided by WF 177928 and RF00010, and the approach to this assessment has been guided by principles of the earlier assessment presented in WF 160182.

The scope of this assessment is extended to include additional hinge models, and steel doorsets by simple interpolation.

To support heavy leaves, the proposal indicates the possibility of fitting additional SOSS hinges and require is the hinge centres are at least 300mm apart. This is a conservative measure to avoid the risk of any adverse cumulative effect of additional mortises too close to each other, especially for timber doorsets.

Target timber and timber composite doorsets are to be supported by fire resistance test data showing the leaves were fitted either a mortice lock or, a concealed overhead door closer. This is intended to establish the principle that the door leaf edges are able to tolerate mortised components.

The available test data generally relates to hinges with laminated links. The 'Hercules' or 'Super' models 216H, 218H, and 220H, alternatively designated SHH416, SHH418, and SHH220AS, respectively, have solid links as shown in Figures 9, 10, and 11.

Despite having solid links, Hercules hinges models are of materially and dimensionally similar to models with laminated links and are included in the scope of this assessment as functional alternatives.

In addition to the presence of alloy components, which limits hinges to 30-minute applications, the width of the hinge forend has been noted:

Hinge model number Forend width, mm

216, 416	26mm
218, 418	29mm
220, 420	35mm

See Figure 1 for illustrated dimensions.

Narrower hinges require smaller mortices and cause reduced interruption of leaf edge intumescent seals and have been assessed for all periods. Hinges with wider forends require larger mortices and have generally been assessed for leaves less likely to be critically eroded by charring, and steel leaves.

SOSS hinge installation, timber doorsets

The proposed SOSS hinges are fitted at the leaf edges and represent a potential heat conduction path across the vulnerable leaf edge clearance gap.

However, unlike butt hinges, the knuckles of which are directly exposed, the proposed SOSS hinges are not directly exposed and any risk associated with heat conduction is delayed. This is considered an initial benefit.

While butt hinges are essentially surface mounted, SOSS hinges are mortised into both the frame and the leaf edge. During the later stages of a standard fire test, the mortises can represent potential areas of weakness, particularly in the leaf edge, which has effectively been reduced in thickness.

To support the principle of mortised components, consideration has been given to the mortised latches fitted to the doorsets as tested and described in WF 177928 and RF00010.

The proposed installation conditions for timber doorsets are derived from the test data provided by WF 177928 and RF00010. The conditions reproduce the critical specifications incorporated in the original test specimens necessary to achieve respective performances of 30 and 60 minutes integrity.

For both 30 and 60-minute performances, SOSS hinges are to be bedded on intumescent sealant as tested, the difference in the installation methods incorporates the lower timber density of the leaf edge and door frame described in WARRES No. 55463.

The assessment includes a range of hinge models, which are similarly of steel and are of similar or smaller dimensions to those as tested in WF 177928 and RF00010.

Hinge models 220 and 420 are approximately 35mm wide and have therefore been excluded for timber based doorsets because of the limited residual thickness of leaf material compared with the tested doorsets, which were fitted with model 418 (218SS) hinges of approximately 28mm wide.

Controlling the dimensions of permissible hinges maintains a similar or reduced risk in terms of quantity of leaf and frame material removed, leaving a similar or greater residual thickness of a door leaf and frame section.

The proposal also includes the option of adjustable hinge models. These are basically similar to standard models except they feature slotted holes for the fixing screws and are fitted into elongated mortises. This allows vertical adjustment of the leaf. The proposal requires that after the final adjustment, the elongated mortises be completely filled with intumescent sealant, which is expected to adequately protect the voids at the ends of the hinge blades.

Timber composite doorsets

Timber composite doorsets with mineral board sub-facings have been proposed in combination with the larger 420SS (square forend) and 220SS (rounded forend) model hinges, which are 35mm wide.

The conditions of the proposal ensure the hinges occur between sub-facings of calcium silicate board, which are expected to protect the mortices and assist in maintaining the viability of the hinge fixings, and contribute towards integrity performance.

The additional lengths of intumescent seal adjacent to the hinge positions are further expected to compensate for the width of the hinges and ensure integrity performance is maintained.

Hinge models with closers, for timber and timber composite door leaves

The proposed hinge models that incorporate concealed spring closers require larger mortices for the leaf component. However, the additional spring mechanism is no wider than the main body of the spring. The leaf mortice is therefore not increased in width and the residual thickness of the leaf is not affected.

It is therefore expected that erosion of the leaf coincident with the spring mechanism will present no increase in risk. To ensure this is the case, the proposal ensures the entire hinge body and spring mechanism are protected with intumescent material and the mortice is formed in solid leaf construction.

Steel doorsets

Unlike the timber doorsets for periods of 30 and 60 minutes, steel doorsets required to provide up to 240 minutes integrity will not be subject to the risk of erosion of either the leaf edge of frame profile.

The main consideration is that the SOSS hinges remain in place and support the leaf. It is for this reason that zinc alloy hinges are not assessed for steel leaves. Zinc alloy has a relatively low melting point and is likely to soften prematurely if fitted to uninsulated steel doorsets.

The steel variants of the proposed hinge models are materially similar to the proposed leaf and frame construction, and therefore do not represent a weakness in terms of inherent material response.

The simple requirement that the SOSS hinges are completely of steel and appropriate to the size steel leaf is considered adequate to ensure a contribution equivalent to steel butt hinges being replaced.

BS EN 1634-1

Test results from BS 476-22:1987 and BS EN 1634-1 are not equivalent because of technical differences in the testing equipment and procedures.

However, the temperature/time regimes for both test methods are similar. The proposed hinges are relatively small metallic components and will exhibit a simple thermal response when included in a fire resistance test specimen. It is expected that after a given period, hinges will be at comparable temperatures regardless of the test method.

Critically, zinc alloy hinge parts are likely to soften or become molten within 30 minutes exposure to either test, and steel parts are expected to remain intact and persist for at least 240 minutes.

To ensure applicability of the proposed SOSS hinges, the conditions of the proposal ensure the target doorsets tested in accordance with BS EN 1634-1 will have been fitted with a mortised item of ironmongery at least as onerous as the proposed hinge in terms of mortice and forend size.

It is considered reasonable to use the supporting fire test data in accordance with BS 476-22:1987 in combination with the condition relating to forend and mortice sizes in order to support the use of the proposed hinges for target doorsets supported by test data in accordance with BS EN 1634-1.

There is no additional condition for steel doorsets. The proposed hinges, leaf edges, and door frames are all of steel. The installed steel hinge parts effectively reinstate the mortices in the steel leaf edges and frame with similar material.

Furthermore, the inherent thermal resistance of steel is considered to reduce the significance of the differences between BS 476-22:1987 and BS EN 1634-1 for the required period of up to 240 minutes.

Overall performance

The proposal is considered adequately supported by the available data, the critical aspects of which are to be reproduced to justify a positive assessment for the required periods of 30 and 60 minutes.

The absence of any introduced combustible material and similarity in general function is considered to represent a like-with-like substitution for steel leaves in terms of contribution to fire resistance performance the required periods of up to 240 minutes.

TABLE 1.

Summary of the scope of application of this report.

SOSS hinges models, basic materials of construction*	Integrity performance in minutes	
	Timber and timber composite doorsets	Steel doorsets with hollow or mineral based leaf cores
Zinc alloy bodies, steel links: 216F, 218F, 216FIC, 218FIC Steel bodies and steel links: 416, 418, 416SS, 418SS 216H/SHH416, 218H/SHH418 416IC, 418IC, 416SSIC, 418SSIC	30 For ≥44mm thick leaves See 5.1.1.1 and 5.1.1.2	N/A
Zinc alloy bodies, steel links: 216F, 218F, 220F, 216FIC, 218FIC, 220FIC Steel bodies and steel links: 416, 418, 420, 220AS, 416SS, 418SS, 420SS, 220SS 216H/SHH416, 218H/SHH418, 220H/SHH220AS 416IC, 418IC, 220ASIC, 416SSIC, 418SSIC, 220SSIC	30 For ≥50mm thick leaves See 5.1.1 and 5.1.1.3	N/A
Steel bodies and steel links: 416, 418, 416SS, 418SS, 216H/SHH416, 218H/SHH418, 416IC, 418IC, 416SSIC, 418SSIC	60 For ≥54mm thick leaves with flaxboard cores See 5.1.1.1 and 5.1.1.4	N/A
Steel bodies and steel links: 416, 418, 420, 220AS, 416SS, 418SS, 420SS, 220SS 216H/SHH416, 218H/SHH418, 220H/SHH220AS 416IC, 418IC, 220ASIC, 416SSIC, 418SSIC, 220SSIC	60 ≥54mm thick leaves See 5.1.1.1 and 5.1.1.5	Up to 240 See 5.1.1.1 and 5.1.1.6
NOTES All hinge components fully bedded on Lorient intumescent sheet material or intumescent sealant at least 2mm thick. 416, 418, 420: full carbon steel models AS: full carbon steel models SS: full stainless steel models H: Hercules hinges, all steel, solid links, see Figures 9, 10, 11 IC, SSIC: models with integral spring closer mechanisms All other models have zinc alloy bodies with steel links See 5.1.1.1 – 5.1.1.5 for details of leaf constructions, minimum timber density for leaf edges and frames, and use of intumescent protection		

Figure 1 General dimensional details of the proposed 216, 218, 418, 220, and 420 SOSS hinges, reproduced from promotional literature. Not to scale.

Dimension	216	218, 418	220, 420
A	1"(25.40mm)	1 ¹ / ₈ "(28.58mm)	1 ³ / ₈ "(34.93mm)
B	2 ³ / ₃₂ "(18.26mm)	7/ ₈ "(22.23mm)	1 ¹ / ₁₆ "(26.99mm)
C	4 ⁵ / ₈ "(117.48mm)	4 ⁵ / ₈ "(117.48mm)	5 ¹ / ₂ "(139.70mm)
D	7/ ₃₂ "(5.56mm)	3/ ₈ "(9.53mm)	1/ ₂ "(12.70mm)
E	1/ ₄ "(6.35mm)	1/ ₄ "(6.35mm)	9/ ₃₂ "(7.14mm)
F	2 ¹⁹ / ₃₂ "(65.88mm)	2 ⁷ / ₁₆ "(61.91mm)	2 ¹⁵ / ₁₆ "(74.61mm)
G	1/ ₁₆ "(1.59mm)	1/ ₁₆ "(1.59mm)	1/ ₁₆ "(1.59mm)
H	1 ⁷ / ₁₆ "(36.51mm)	1 ⁴¹ / ₆₄ "(41.67mm)	1 ¹⁵ / ₁₆ "(49.21mm)
I	1 ⁵ / ₃₂ "(11.91mm)	1 ³ / ₃₂ "(10.32mm)	1 ⁵ / ₃₂ "(11.91mm)

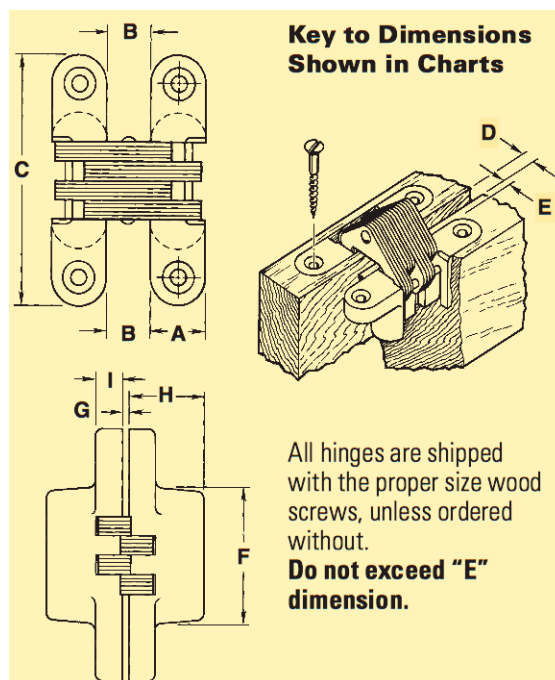


Figure 2 Comparison of 416SS, 418SS, 220SS, and 420SS hinge models. Not to scale.

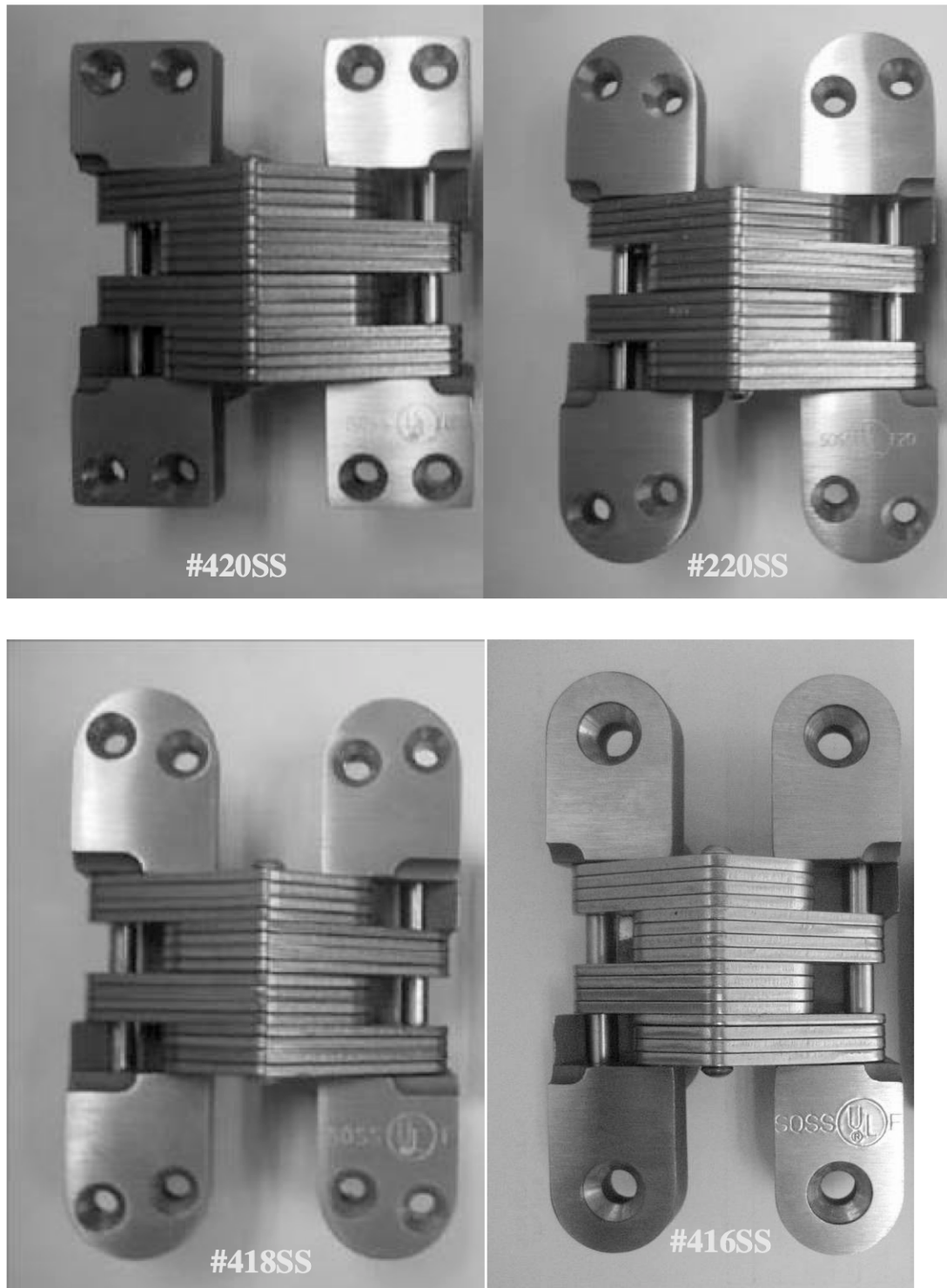


Figure 3 General dimensional details of the proposed 220ASIC SOSS closer hinges, reproduced from information provided by the Applicant. Not to scale.

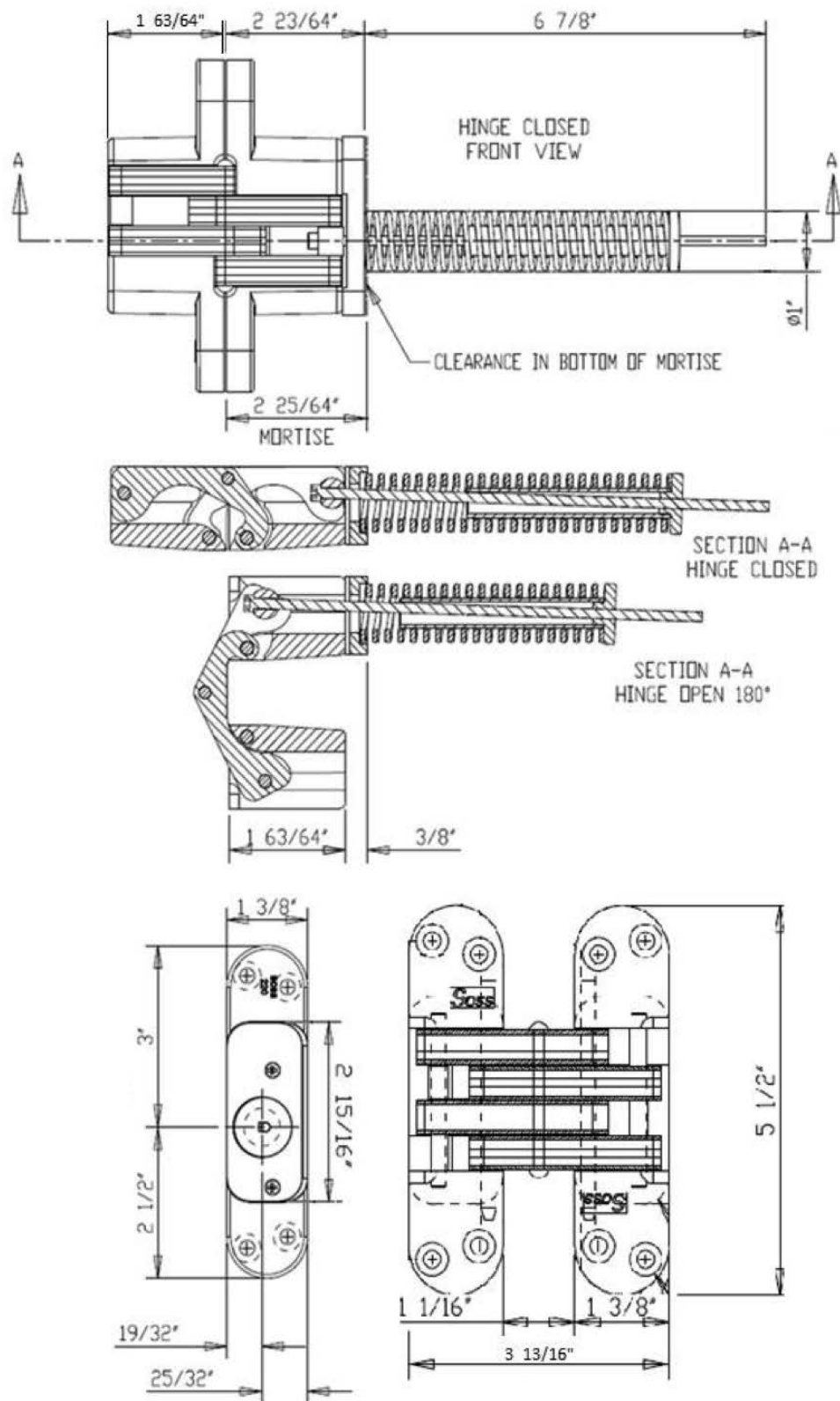


Figure 4 General dimensional details of the proposed 418IC SOSS closer hinges, reproduced from information provided by the Applicant. Not to scale.

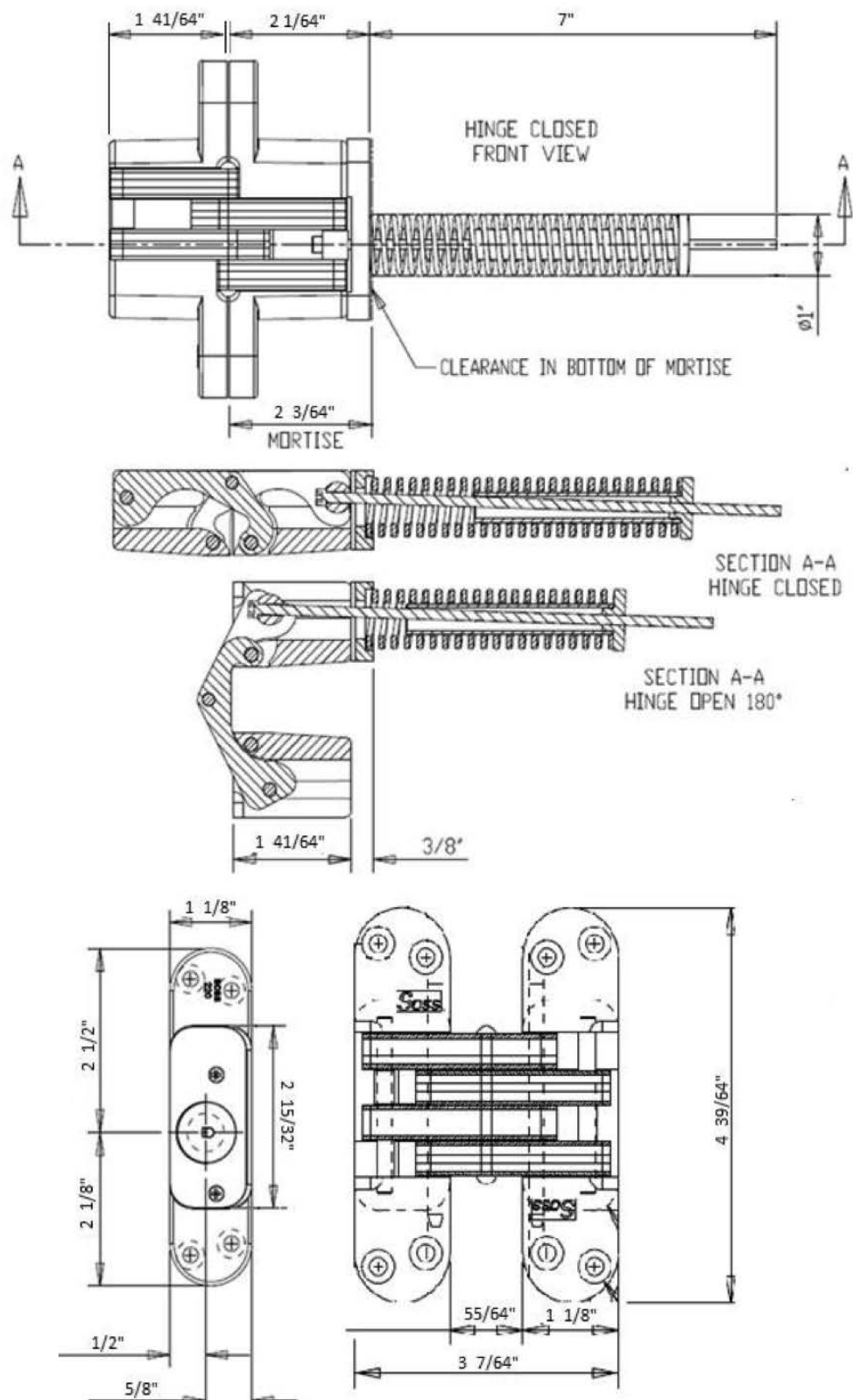


Figure 5 General dimensional details of the proposed 416IC SOSS closer hinges, reproduced from information provided by the Applicant. Not to scale.

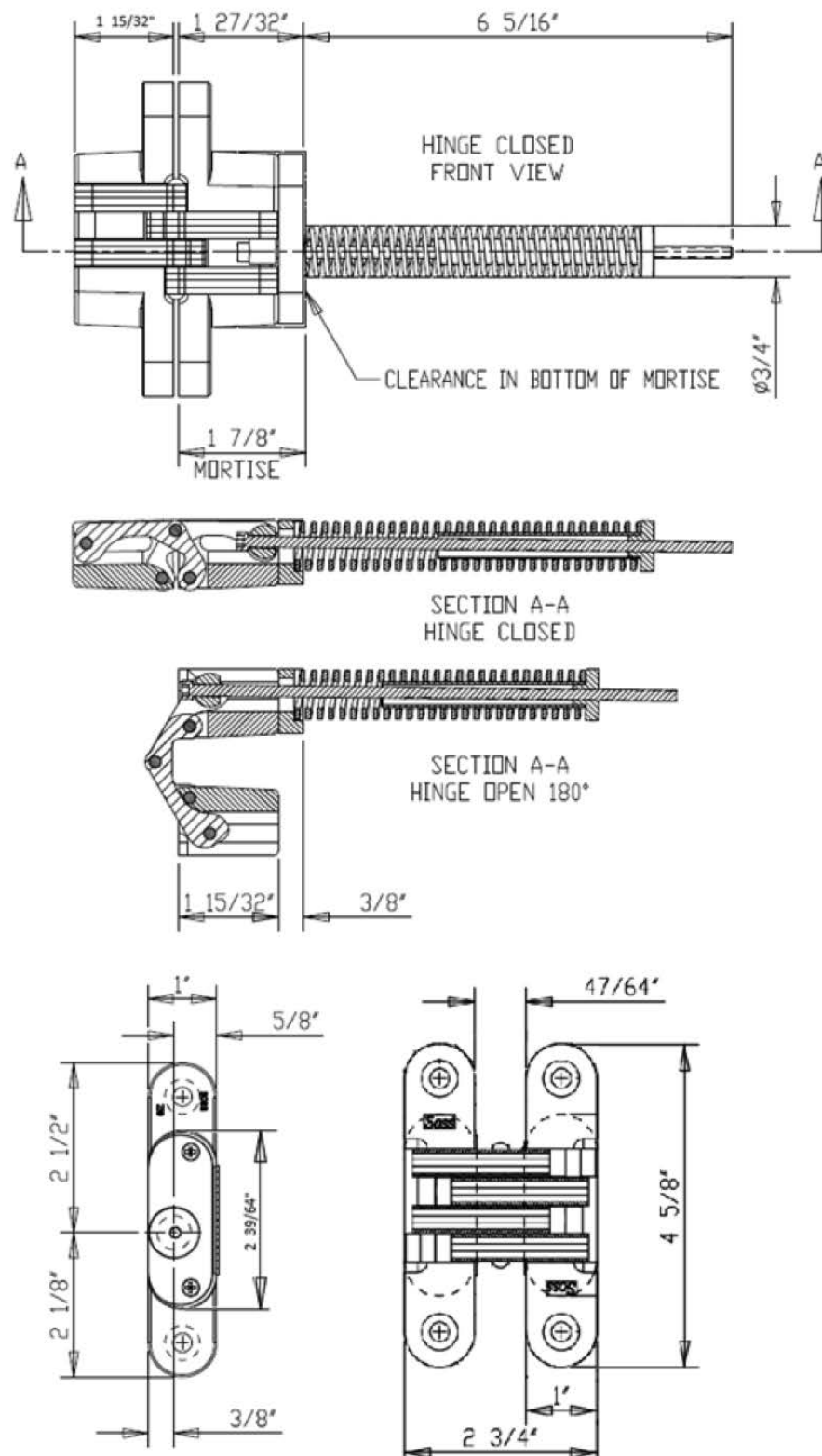


Figure 6 General dimensional details of the proposed 216FIC SOSS closer hinges, reproduced from information provided by the Applicant. Not to scale.

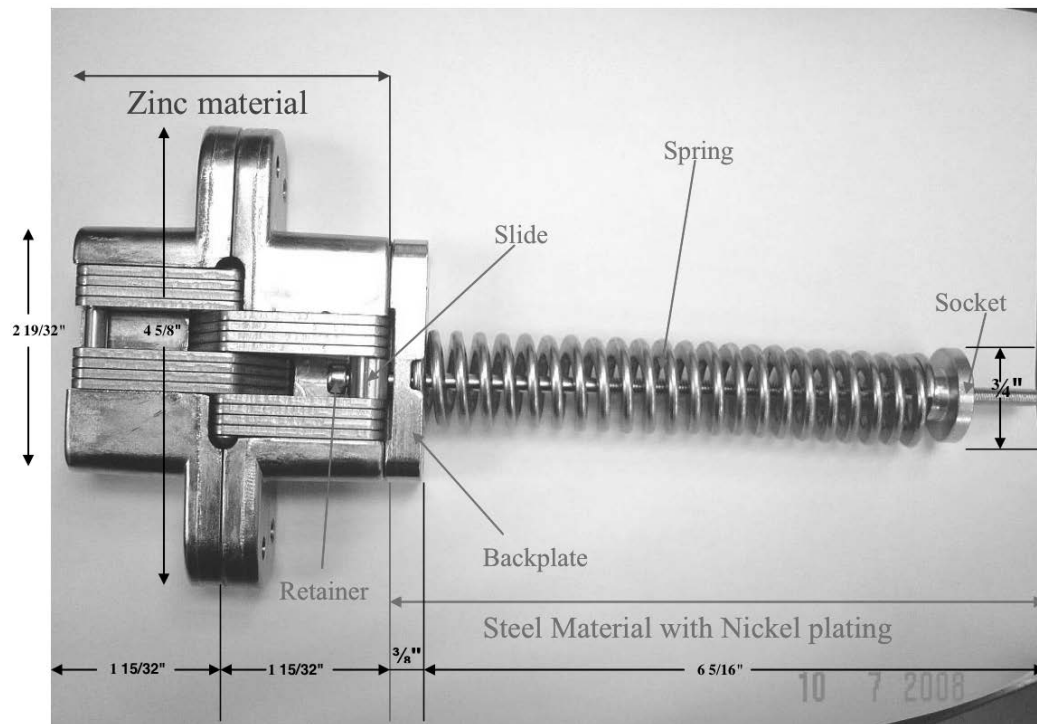


Figure 7 General dimensional details of the proposed 218FIC SOSS closer hinges, reproduced from information provided by the Applicant. Not to scale.

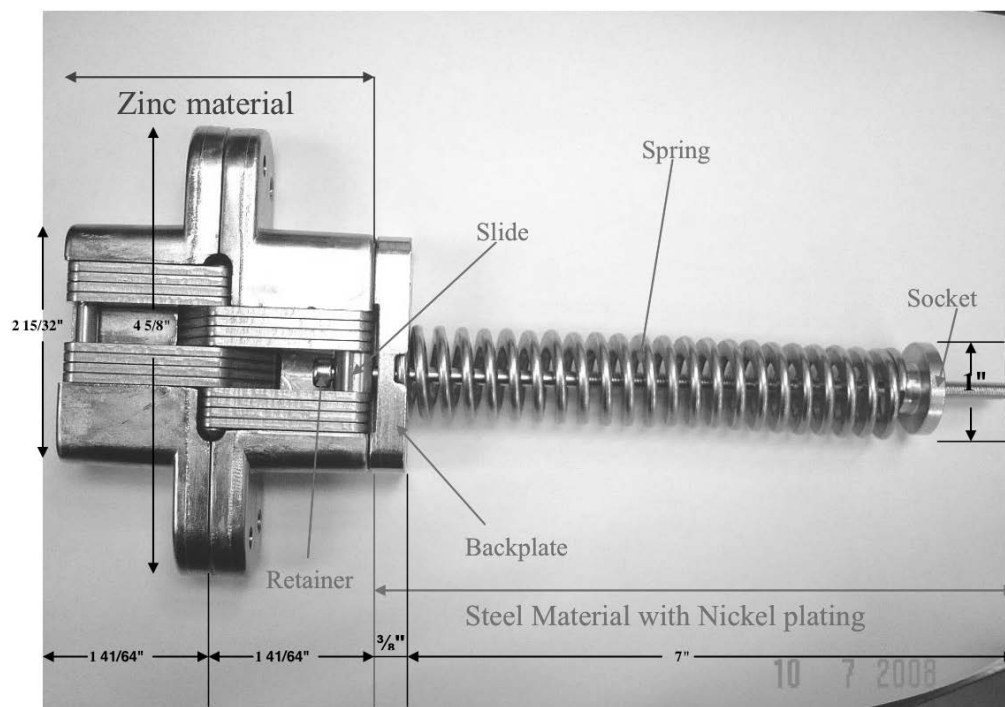


Figure 8 General dimensional details of the proposed 220FIC SOSS closer hinges, reproduced from information provided by the Applicant. Not to scale.

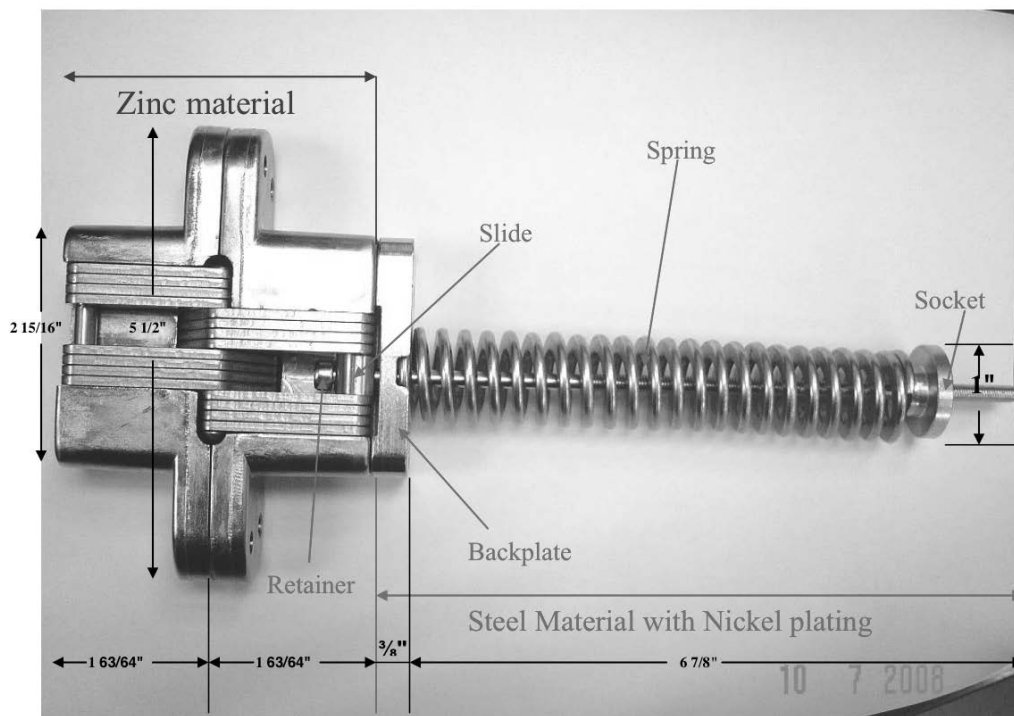
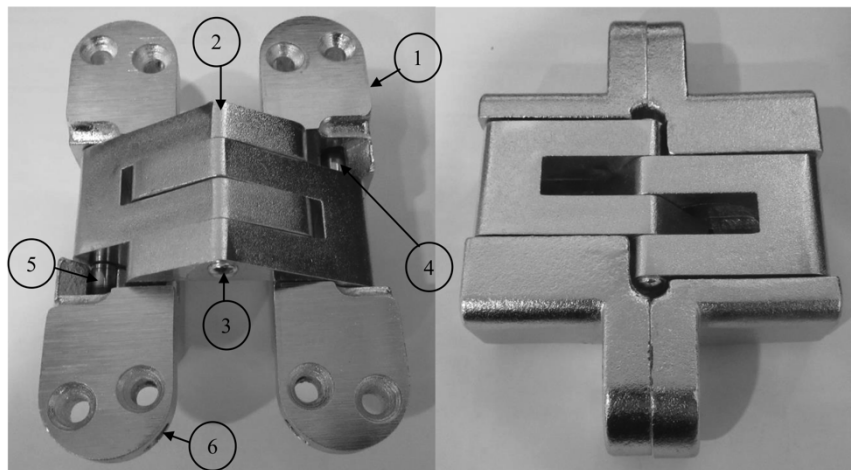


Figure 9 General details of the proposed SHH418 (218H) hinges, reproduced from information provided by the Applicant. Not to scale.

Item	Components	Qty	Material	Finishes come in
1	Casting Body	2	AISI 4140	1) US4 - Satin Brass 2) US26D - Satin Chrome
2	Bunch	1	AISI 4140	
3	Rivet Pin	1	Stainless Steel 316	
4	Channel Pin	2	AISI 4140	
5	Rollers	2 sets	AISI 4140	
6	Long Pin	2	AISI 4140	



Steel Casting Body

Individual Steel links



Special Investment Casting Material. Harden Steel Body

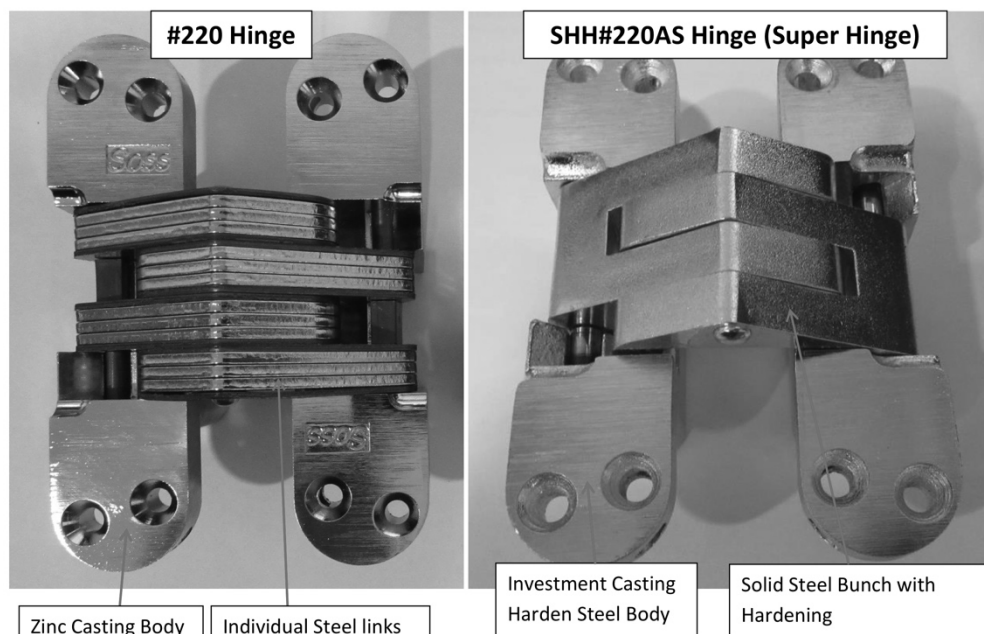
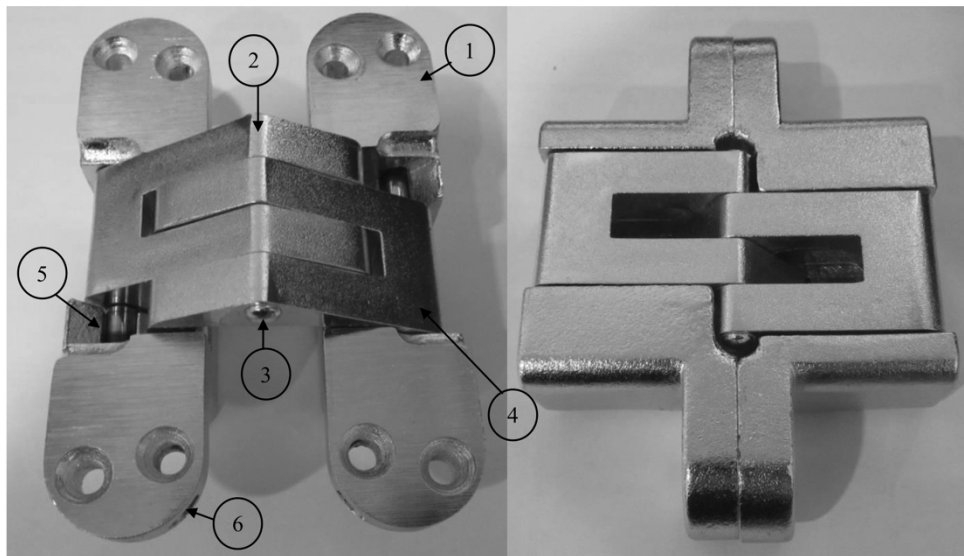
Special Solid Steel Bunch and Hardened

*Note: All the dimensions for both model #418 and SHH#418 is exactly the same.

Figure 10 General details of the proposed SHH220AS (220H) hinges, reproduced from information provided by the Applicant. Not to scale.

Technical Data Product Sheet - SHH#220

Item	Components	Qty	Material	Finishes come in
1	Casting Body	2	AISI 4140	1) US4 - Satin Brass 2) US26D - Satin Chrome
2	Bunch	1	AISI 4140	
3	Rivet Pin	1	Stainless Steel 316	
4	Channel Pin	2	AISI 4140	
5	Rollers	2 sets	AISI 4140	
6	Long Pin	2	AISI 4140	



*Note: All the dimensions for both model #220 and SHH#220AS is exactly the same.

Figure 11 Comparison of the proposed 216H/SHH416, 218H/SHH418, and 220H/SHH220AS hinges, reproduced from information provided by the Applicant. Not to scale.

For dimensions, see Figure 1.



6. Conclusions

This conclusion relates to target doorsets supported by fire test evidence with respect to either BS 476-22:1987 or, BS EN 1634-1, and the integrity performances of the target doorsets indicated in the original fire test reports.

If target doorsets had been modified as described in Section 5 of this report, it is expected that indicative integrity performances of up to 240 minutes would have been maintained coincident with the proposed SOSS hinge models.

Validity of supporting data

This Conclusion is conditional on the referenced test reports being currently valid.

7. Supporting data

The report summaries in are for information only. Reference should be made to complete copies of test reports for full specimen and performance details.

7.1 Fire resistance test report WF 177928

An additional version of report of a fire resistance test, originally issued under reference WARRES No. 55463 by Warrington Fire Research Centre in accordance with BS 476-22:1987 on two single-leaf, single-acting, latched timber doorsets, referenced A and B for the purpose of the test.

Doorset A had a 45mm thick leaf having a flaxboard core within a framework of medium density fibreboard (MDF), faced with plywood, and hung in a softwood frame on three SOSS hinges, including two steel SOSS 218SS (now 418SS, see 7.4) hinges and one steel SOSS 218 (now 418, see 7.4) closer hinge.

Doorset B had a 45mm thick leaf based on a core of softwood lamels faced with plywood and hung in a softwood frame on 218 SOSS hinges with bodies of die-cast zinc alloy and steel links.

The intumescent leaf edge seals fitted in the leaf edges were fully interrupted at the hinge positions. Both hinge components, in the leaf edge and in the frame, were fully bedded on Lorient intumescent sealant.

	Doorset A (steel hinge body)	Doorset B (zinc alloy hinge body)
Integrity	30 minutes*	30 minutes*
Insulation	30 minutes*	30 minutes*
Test Date	13th December 1991	
Report for	SOSS Asia Pte Ltd	

*No failure. The test was discontinued in order to examine the hinges. No actual or potential integrity weakness observed at the hinge positions.

7.2 Fire resistance test report RF00010

A report of a fire resistance test by Chiltern International Fire Ltd in accordance with BS 476-22:1987 on a single-acting, single-leaf doorset that opened towards the heating conditions.

The door leaf was 2040mm high by 828mm wide by nominally 54mm thick and comprised a core of flaxboard of nominally 477kg/m³ by 48mm thick within a perimeter timber framework of stiles of 69mm by 48mm by 711-793kg/m³, rails of 75mm by 48mm by 711-793kg/m³, and 3mm thick plywood facings. The leaves were hung in a sapele hardwood timber frame.

The leaf was hung on three SOSS 218SS (now 418SS, see 7.5) stainless steel concealed hinges. Both hinge components, in the leaf edge and in the frame, were fully bedded on Lorient intumescent sealant.

The intumescent leaf edge seals fitted in the frame reveal were fully interrupted at the hinge positions.

A latch was fitted but was disabled for the purpose of the test.

Integrity	64 minutes*
Insulation	64 minutes
Test Date	21 st February 2000
Test Sponsor	N V Tools Ltd

* Sustained flaming was observed from approximately mid-height upwards at both the leading and hanging edges.

7.3 Assessment report WF 160182

A report presenting an assessment providing a general scope of application for SOSS 218SS (stated, see 7.5) hinges when fitted to timber and mineral based doorsets required to provide 30 and 60 minutes integrity with respect to BS 476-22:1987, depending on the performance of the doorset as originally tested.

The assessment is supported by reference to test reports WARRES No. 55463 and RF00010.

Report for N V Tools Ltd

7.4 Statement by SOSS Asia Pte Ltd

SOSS model hinges are manufactured by SOSS Asia Pte Ltd, who has stated that:

- all 200 series SOSS hinges are constructed of zinc alloy bodies with steel links,
- all 400SS series SOSS hinges are of full carbon or stainless steel construction,
- initially, stainless steel variants of 218 and 220 hinges were designated 218SS and 220SS,
- 218SS hinges are now designated 418SS,
- model reference 220SS has been retained to describe a steel hinge variant with rounded forends while 420SS refers to a generally similar hinge but with square forends, see Figure 2,
- the second two digits of the model number refer to the hinge size, i.e. 216, 218, and 220 model hinges are the same sizes as 416SS, 418SS, and 420SS hinges, respectively.
- depending on the geographical market, 'Hercules' or 'Super' hinges have different model references:

<u>SOSS Asia Part No.</u>	<u>UIP Website Part No.</u>
SHH#416	216H
SHH#418	218H
SHH#220AS	220H

Global locations



Warringtonfire Singapore Pte
Ltd Reg no 200912511W

Raffles Place
#26-01 Republic Plaza
Singapore, 048619
T: +65 6372 5600
F: +65 6863 3004

Fire resistance testing locations

Warringtonfire- UKAS accredited laboratory
Holmesfield Road, Warrington, WA1 2DS, UK

BM TRADA- UKAS accredited laboratory
Chiltern House, Stocking lane, High Wycombe, HP14 4ND, UK

Warringtonfire Gent- BELAC accredited laboratory
Ottergemsesteenweg-Zuid 711, 9000 Gent, Belgium

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