

FIRE ASSESSMENT REPORT

FC11076-01-3

FIRE RESISTANCE OF GIB FIRE RATED SUSPENDED CEILINGS AND NON-LOADBEARING WALLS WITH ECOPLUS FRAMING

CLIENT

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ASSESSMENT OBJECTIVE

To assess the fire resistance of the Winstone Wallboards Ltd fire rated systems with Ecoplus framing as follows:

- Floor/ceiling system specification GBSC 30, GBUC 30, GBSC 60a and GBUC 60 constructed using the Ecoplus suspended ceiling framing system lined with 13 mm or 16 mm thick GIB Fyreline® plasterboard.
- Non-loadbearing wall specification GBS30, GBSA30b, GBS90 and GBSA90c lined with GIB® plasterboard.

CONCLUSION

Floor/ceiling systems

It is considered that the following Ecoplus suspended ceiling steel framing system would not be detrimental to the fire resistance of the following Winstone Wallboards Ltd suspended ceiling systems, when tested in accordance with AS 1530.4:2014:

- GBSC 30 with a ceiling lining of one layer of 13 mm GIB Fyreline® plasterboard; or
- GBUC 30 with a ceiling lining of one layer of 16 mm GIB Fyreline® plasterboard; or
- GBSC 60a with a ceiling lining of two layers of 13 mm GIB Fyreline® plasterboard; or
- GBUC 60 with a ceiling lining of two layers of 13 mm GIB Fyreline® plasterboard.

provided that the fixing of the lining and support spacings are in accordance with these published specifications and the Ecoplus grid is designed to meet ambient structural criteria for strength and serviceability under dead and live loads.

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Non-loadbearing walls

It is considered that the following GIB® fire rated non-loadbearing steel framed plasterboard wall systems with Ecoplus framing would achieve the stated fire resistance if tested in accordance with AS 1530.4:2014 as follows:

GIB® system	Ecoplus stud size(depth/BMT)	Stud spacing	Maximum wall height	Expansion at top of studs
GBS30 GBS60	64/0.75 mm	600 mm	3,000 mm	15 mm
		400 mm	3,200 mm	15 mm
	90/0.75 mm 92/0.75 mm 92/1.15 mm 150/0.75 mm	600 mm	4,200 mm	20 mm*
		400 mm	4,800 mm	25 mm*
GBSA30b GBSA90c	64/0.75 mm	600 mm	2,700 mm	15 mm
		400 mm	3,000 mm	15 mm
	90/0.75 mm 92/0.75 mm 92/1.15 mm 150/0.75 mm	600 mm	4,200 mm	20 mm*
		400 mm	4,800 mm	25 mm*
GBS90	92/0.75 mm	600 mm	2,930 mm	15 mm
		400 mm	3,350 mm	15 mm
	92/1.15 mm 150/0.75 mm	600 mm	3,000 mm	15 mm
		400 mm	3,400 mm	15 mm

* Use a minimum 50 mm deep head channel

LIMITATION

This report is subject to the accuracy and completeness of the information supplied.

BRANZ reserves the right to amend or withdraw this assessment if information becomes available which indicates the stated fire performance may not be achieved.

This assessment report may only be quoted or reproduced in full.

TERMS AND CONDITIONS

This report is issued in accordance with the Terms and Conditions as detailed and agreed in BRANZ Services Agreement for this work.

The results reported here relate only to the item/s described in this report.

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CONTENTS

TABLES

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1. INTRODUCTION

This report gives BRANZ's assessment of the fire resistance of Winstone Wallboards Ltd fire rated walls and floor ceilings with Ecoplus framing as follows:

- Floor/ceiling system specification GBSC 30, GBUC 30, GBSC 60a and GBUC 60 constructed using the Ecoplus suspended ceiling framing system lined with 13 mm or 16 mm thick GIB Fyreline® plasterboard.
- Non-loadbearing wall specification GBS30, GBSA30b, GBS90 and GBSA90c lined with GIB® plasterboard.

2. BACKGROUND

2.1 BRANZ fire resistance test FR 6073

In BRANZ fire resistance test FR 6073 the test specimen consisted of a loadbearing floor/ceiling system nominally 3,000 mm wide and with a 4,000 mm span. The floor/ceiling system was constructed with timber joists. To the underside of the joists Rondo clips and battens were used to suspend a ceiling consisting of a double layer of 13 mm GIB Fyreline® plasterboard. Nominally 20 mm thick tongue and groove wood-based flooring was fixed to the top of the joists. The floor cavity included R1.8 (75 mm) Pink® Batts® glass wool insulation.

The loaded floor/ceiling system was tested in accordance with AS 1530.4:2014 and exceeded the requirements for a fire resistance rating (FRR) of 60/60/60.

2.2 BRANZ fire resistance test FR 1572

In BRANZ fire resistance test FR 1572 the test specimen consisted of a loadbearing floor/ceiling system nominally 3,000 mm wide and with a 4,000 mm span using Twinaplate joists, with a ceiling of nominally 13 mm GIB Fyreline® plasterboard.

The loaded floor/ceiling system was tested in accordance with AS 1530.4-1990 and exceeded the requirements for an FRR of 30/30/30.

2.3 Non-loadbearing steel stud testing

On behalf of Winstone Wallboards Limited BRANZ has undertaken a number of fire resistance tests on non-loadbearing steel framed plasterboard wall systems in accordance with AS 1530.4 in support of the Winstone Wallboards Ltd GIB® Fire Rated Systems Specification and installation manual (October 2018).

3. DISCUSSION

3.1 Comparison between test standards

3.1.1 General

In the fire resistance test FR 1572 described in 2.2 above the specimen was tested in accordance with fire resistance test standard AS 1530.4-1990. This assessment considers the fire resistance of the floor/ceiling in accordance with the current version of the test standard AS 1530.4:2014.

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In respect to a floor/ceiling test the only significant differences between the 1990 and 2014 versions of the AS 1530.4 test standard is the furnace temperature, the criteria for Structural Adequacy and the additional requirement to use a cotton pad test for integrity failure.

3.1.2 Furnace temperature

The 1990 version of the test standard defined the furnace temperature as $T_1-T_0 = 345 \log_{10}(8t+1)$ whereas from 2005 on the furnace temperature is defined as $T= 345 \log_{10}(8t+1) + 20$ where T_1 and T are the furnace temperature, T_0 is the ambient temperature and t is the time in minutes of the test duration. For ambient temperatures in the normal range experienced at BRANZ the difference in area under the average furnace temperature curve is less than 1% for periods up to 60 minutes. This is within the tolerance defined by the test standard.

3.1.3 Cotton pad test

To test for passage of hot gases from the exposed to unexposed face of the test specimen the 2014 version of the test standard requires that a cotton pad test be applied to any gaps which develop in the specimen during the fire exposure. This test applies up until the surface of the specimen adjacent to the gap being tested exceeds 300ºC. This was not a requirement for tests to the earlier versions of the AS test standard. When the cotton pad test is no longer applicable the 6 mm x 150 mm and 25 mm gap criteria are used.

In BRANZ fire resistance test FR 1572 there was no reported gap or fissure development during the test and hence there was no need for the application of a cotton pad for the duration of the test.

3.1.4 Structural Adequacy failure criteria

In the 1990 version of the test standard the failure in relation to Structural Adequacy is determined to occur when the deflection exceeds L/20 where L is the clear span of the floor, whereas for the 2014 version of the test standard the deflection limit is $L^2/400$ or, in both standards, the rate of deflection exceeds $L^2/9000d$ where d is the depth of the floor joist. In fire resistance test FR 1572 the specimen failed the Structural Adequacy criterion well beyond the stated FRR.

It is therefore considered that the FR 1572 floor/ceiling tested in accordance with the 1990 version of the test standard is likely to achieve a similar fire resistance when tested in accordance with the current test standard AS 1530.4:2014.

3.2 Fire rated floor/ceiling systems

3.2.1 GBSC 60a and GBUC 60

Winstone Wallboards Ltd specifications GBSC 60a (GIB® Fire Rated Systems, 2018) consist of a structural timber floor frame from which is suspended a steel framework to carry the plasterboard lining. A strand board or particle board flooring is fixed to the upper surface of the timber frame. These systems have been tested and exceeded the requirements for an FRR of 60/60/60 with two layers of 13 mm thick GIB Fyreline® plasterboard as the ceiling lining.

During fire resistance test FR 6073 temperature data was collected on the upper surface of, and between the two layers, of the 13 mm GIB Fyreline® plasterboard. Based on this

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temperature data and an examination of the Ecoplus steel suspension system, it is considered that the GBSC 60a system would achieve an FRR of 60/60/60 when tested in accordance with AS 1530.4:2014. All other details must be in accordance with the published specification.

It is also considered the Ecoplus steel suspension system can be used with the Winstone Wallboards Ltd specification GBUC 60 (GIB® Fire Rated Systems, 2018) which permits lining support framing designed to meet ambient structural criteria for strength and serviceability under dead and live loads.

3.2.2 GBSC 30 and GBUC 30

Winstone Wallboards Ltd specification GBSC 30 (GIB® Fire Rated Systems, 2018) consists of a structural timber floor frame from which is suspended a steel framework to carry the plasterboard lining. Wood-based flooring is fixed to the upper surface of the timber frame. This system has been determined to achieve an FRR of 30/30/30 with a lining of one layer of 13 mm thick GIB Fyreline® plasterboard.

During fire resistance test FR 1572 temperature data was collected on the upper surface of the nominally 13 mm GIB Fyreline® ceiling lining. Based on this temperature data, and an examination of the Ecoplus steel suspension system, it is considered that GBSC 30, with the Ecoplus suspension system, would achieve an FRR of 30/30/30 when tested in accordance with AS 1530.4:2014. All other details must be in accordance with the published specification.

It is also considered that the Ecoplus steel suspension system can be used with the Winstone Wallboards Ltd specification GBUC 30 (GIB® Fire Rated Systems, 2018) which has a lining of one layer of 16 mm thick GIB Fyreline® which has a thicker lining than the GBSC 30 system and which permits lining support framing designed to meet ambient structural criteria for strength and serviceability under dead and live loads.

3.3 Non-loadbearing wall systems

Winstone Wallboards Ltd have undertaken a number of fire resistance tests on non-loadbearing steel framed plasterboard walls and achieved the fire resistance ratings as stated in the Winstone Wallboards Ltd specification GBUC 60 (GIB® Fire Rated Systems, 2018) with a given stud size. When changing the framing the stud properties need to be considered and compared against what was tested to ensure the framing offers no less flexural rigidity than what was tested.

The flexural rigidity of the wall with alternative framing has been considered using an empirical formula derived from BRANZ research based on the length and flexural rigidity of the studs. Without considering the influence of the lining, which is assumed to be significantly weakened in the fire exposure, in order to maintain an equivalent fire performance the stud numbers (spacing) and/or height are required to be revised to accommodate different stud properties.

From BRANZ research into the fire resistance of non-loadbearing steel framed walls the relationship, in terms of stud depth and height maintains structural similarity when considering formed steel sections of similar shapes. Where shapes differ widely, as in the case of non-similar shapes or composite structures such as stud walls, the ‘second moment of area’ for the stud (I) better describes the relationship from a flexural rigidity perspective such that height may be increased proportionately with the 3rd root of I_{xx}. The stud sizes and properties supplied by Ecoplus Systems are listed in Table 1 below.

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Table 1: Ecoplus System Stud Properties

Ecoplus stud size(depth/BMT)	Flange (mm)	Second Moment of Area (cm^4)		Section Modulus (cm^3)	
		Ixx	Iyy	Zxx	Zyy
64/0.75 mm	45	10.57	4.38	3.25	1.61
90/0.75 mm	45	20.10	4.90	4.48	1.68
92/0.75 mm	33.5	15.81	1.56	3.43	0.62
92/1.15 mm	33.5	23.65	2.28	5.14	0.91
150/0.75 mm	45	*	*	*	*

* Properties not supplied. Assessment based on 90/0.75 mm stud properties.

Based on the above BRANZ research and the information from the reports referenced above, it is considered the Ecoplus framing would not compromise the FRR of the GIB® fire rated walls as given in Table 2.

Table 2: GIB® Systems and heights with Ecoplus framing

GIB® system	Ecoplus stud size(depth/BMT)	Stud spacing	Maximum wall height	Expansion at top of studs
GBS30 GBS60	64/0.75 mm	600 mm	3,000 mm	15 mm
		400 mm	3,200 mm	15 mm
	90/0.75 mm	600 mm	4,200 mm	20 mm*
		400 mm	4,800 mm	25 mm*
	92/0.75 mm	600 mm	4,200 mm	20 mm*
		400 mm	4,800 mm	25 mm*
	92/1.15 mm	600 mm	4,200 mm	20 mm*
		400 mm	4,800 mm	25 mm*
	150/0.75 mm	600 mm	4,200 mm	20 mm*
		400 mm	4,800 mm	25 mm*
GBSA30b GBSA90c	64/0.75 mm	600 mm	2,700 mm	15 mm
		400 mm	3,000 mm	15 mm
	90/0.75 mm	600 mm	4,200 mm	20 mm*
		400 mm	4,800 mm	25 mm*
	92/0.75 mm	600 mm	4,200 mm	20 mm*
		400 mm	4,800 mm	25 mm*
	92/1.15 mm	600 mm	4,200 mm	20 mm*
		400 mm	4,800 mm	25 mm*
	150/0.75 mm	600 mm	4,200 mm	20 mm*
		400 mm	4,800 mm	25 mm*
GBS90	92/0.75 mm	600 mm	2,930 mm	15 mm
		400 mm	3,350 mm	15 mm
	92/1.15 mm	600 mm	3,000 mm	15 mm
		400 mm	3,400 mm	15 mm
	150/0.75 mm	600 mm	3,000 mm	15 mm
		400 mm	3,400 mm	15 mm

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4. CONCLUSION

4.1 Suspended ceiling systems

It is considered that the Ecoplus suspended ceiling steel framing system would not be detrimental to the fire resistance of the following Winstone Wallboards Ltd suspended ceiling systems, when tested in accordance with AS 1530.4:2014:

- GBSC 30 with a ceiling lining of one layer of 13 mm GIB Fyreline® plasterboard; or
- GBUC 30 with a ceiling lining of one layer of 16 mm GIB Fyreline® plasterboard; or
- GBSC 60a with ceiling lining of two layers of 13 mm GIB Fyreline® plasterboard; or
- GBUC 60 with ceiling lining of two layers of 13 mm GIB Fyreline® plasterboard,

provided that the fixing of the lining and support spacings are in accordance with these published specifications and the Ecoplus grid is designed to meet ambient structural criteria for strength and serviceability under dead and live loads.

4.2 Non-loadbearing wall systems

It is considered that the following GIB® fire rated non-loadbearing, steel framed, plasterboard wall systems with Ecoplus framing would achieve the stated fire resistance if tested in accordance with AS 1530.4:2014:

GIB® system	Ecoplus stud size(depth/BMT)	Stud spacing	Maximum wall height	Expansion at top of studs
GBS30 GBS60	64/0.75 mm	600 mm	3,000 mm	15 mm
		400 mm	3,200 mm	15 mm
	90/0.75 mm 92/0.75 mm 92/1.15 mm 150/0.75 mm	600 mm	4,200 mm	20 mm*
		400 mm	4,800 mm	25 mm*
GBSA30b GBSA90c	64/0.75 mm	600 mm	2,700 mm	15 mm
		400 mm	3,000 mm	15 mm
	90/0.75 mm 92/0.75 mm 92/1.15 mm 150/0.75 mm	600 mm	4,200 mm	20 mm*
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