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Authorised and notified according to Article 10 of the Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products

MEMBER OF EOTA

European Technical Approval No. ETA-03/0056

(replaces the version valid from 15.03.2004 to 31.05.2010)

Trade name:	Ranti beams
Holder of approval:	Forestia AS N-2435 Braskereidfoss Norway Tel. + 47 6242 8200 Fax+ 47 6242 8278
Generic type and use of construction product:	Wood-based I-shaped composite beams and columns for structural purposes
Valid from: to:	31.05.2010 31.05.2015
Manufacturing plant:	Forestia AS Grubhei N-8607 Mo i Rana Norway Tel. + 47 62 42 82 00 Fax+ 47 75 14 67 51
This European Technical Approval contains:	13 pages including 4 Annexes which form an integral part of the document

I LEGAL BASIS AND GENERAL CONDITIONS

1 This European Technical Approval is issued by Norwegian Building Research Institute (NBI), in accordance with:
- Council Directive 89/106/EEC of 21 December 1988 on the approximation of laws, regulations and administrative provisions of Member States relating to construction products[1], modified by the Counsil Directive 93/68/EEC of 22 July 1993[2]
- Common Procedural Rules for Requesting, Preparing and the Granting of European technical approvals set out in the Annex of Commision Decision 94/23/EC[3].
- Guideline No. 011 for European Technical Approval of "Light Composite Wood-based Beams and Columns".

2 Norwegian Building Research Institute is authorised to check whether the provisions of this European Technical Approval are met. Checking may take place in the manufacturing plant. Nevertheless, the responsibility for the conformity of the products to the European Technical Approval and their fitness for the intended use remains with the holder of the European Technical Approval.

3 This European Technical Approval is not to be transferred to other manufacturers, agents of manufacturers, or manufacturing plants other than those indicated on page 1 of this European Technical Approval.

4 This European Technical Approval may be withdrawn by Norwegian Building Research Institute pursuant to Article 5.1 of Council Directive 89/106/EEC.

5 Reproduction of this European Technical Approval including transmission by electronic means shall be in full. However, partial reproduction can be made with the written consent of Norwegian Building Research Institute. In this case partial reproduction has to be designated as such. Texts and drawings of advertising brochures shall not contradict or misuse the European Technical Approval.

6 The European Technical Approval is issued by the approval body in its official language. This version should correspond fully to the version used by EOTA for circulation. Translations into other languages have to be designated as such.

[1] Official Journal of the European Communities N° L40, 11.2.1989, p. 12
[2] Official Journal of the European Communities N° L 220, 30.08.1993, p. 1
[3] Official Journal of the European Communities N° L17, 20.1.1994, p. 34

II SPECIFIC CONDITIONS OF THE EUROPEAN TECHNICAL APPROVAL

1 Definition of product and intended use

Ranti beams are wood-based composite beams with I-shaped cross sections made of solid wood flanges and particleboard webs. The cross sections with standard material dimensions and tolerances are shown in Annex 1.

Ranti beams are intended to be used as load-bearing beams and columns in building structures. The use is limited to service class 1 and 2 as specified in Eurocode 5 regarding moisture conditions.

The beams are not intended to be used in areas where resistance against termites is required, nor in places where national regulations require declaration of special properties related to seismic actions.

The provisions made in this European Technical Approval are based on an assumed intended working life of 50 years[4].

2 Characteristics of product and methods of verification

ER 1 Mechanical resistance and stability

The mechanical properties of the beams are given in Annex 2.

ER 2 Safety in case of fire

Reaction of fire classification according to EN 13501-1 is class D-s2, d0.

No performance related to resistance to fire has been determined[5].

ER 3 Hygiene, health and environment

Based on the declaration by the manufacturer, the beams do not contain harmful or dangerous substances as defined in the EU database, with exeption of formaldehyde. The formaldehyde potential class of the web board has been classified to be E1 in accordance with EN 13986. The product does not contain pentachlorophenol.

In addition to the specific clauses relating to dangerous substances contained in this European Technical Approval, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.

[4] This means that it is expected that when this working life has elapsed, the real working life may be, in normal use conditions, considerably longer without major degradation affecting the essential requirements of the works. The indications given as to the working life of a beam cannot be interpreted as a guarantee given by the producer or the approval body. They should only be regarded as a means for the specifiers to choose the appropriate criteria for beams in relation to the expected, economically reasonable working life of the works.

[5] Resistance to fire for structures where Ranti beams are incorporated must be determined for the complete construction

ER 4 Safety in use

Not relevant

ER 5 Protection against noise

Not relevant[6]

ER 6 Energy economy and heat retention

The design thermal conductivity λ according to EN 12524 is 0.13 W/(m·K) for the flange material, and 0.14 W/(m·K) for the web material.

Aspects of durability, serviceability and identification

Ranti beams can be used in service class 1 and 2 according to Eurocode 5, and hazard class 1 and 2 as specified in EN 335. The product may be exposed directly to the weather for a short time during installation.

Durability may be reduced by attack from insects such as long horn beetle, dry wood termites and anobium in regions where these may be found.

Identification of the product is shown in Annex 1 and 2.

3 Evaluation of Conformity and CE marking

3.1 Attestation of Conformity System

The system of attestation of conformity specified by the European Commission in Decision 99/92/EC - Official Journal L 29, 03.02.1999 is System 1, according to Council Directive 89/106/EEC Annex III.2.(i), and provides:

(a) Tasks of the manufacturer:
- Factory production control
- Further testing of samples taken at the factory in accordance with a prescribed test plan

(b) Tasks of the notified body:
- Initial type testing of the product
- Initial inspection of factory and of factory production control
- Continous surveillance, assessment and approval of factory production control

3.2 Responsibilities

3.2.1 Tasks of the manufacturer

Factory production control

The manufacturer shall exercise permanent factory production control according to the written quality plan which has been endorsed by the approval body. The factory production control includes checking of incoming components and process controls like additional grading of flange material, glue spread and curing temperatures.

[6] Sound insulating properties for structures where Ranti beams are incorporated must be determined for the complete construction

Testing of samples taken at the factory
Testing of samples taken at the factory according to a prescribed test plan is part of the factory production control. The test plan is deposited at the Norwegian Building Research Institute, and is available to notified bodies involved in the attestation of conformity to this ETA.

3.2.2 Tasks of notified bodies

Intial type-testing of the product
Approval tests have been conducted by the approval body or under its responsibility in accordance with section 5 of ETA Guideline N° 011. The approval body has assessed the results of these tests in accordance with section 6 of the guideline. The product characteristics determined by the initial test programme and subsequent audit testing by an independant test laboratory since 1997 have been found sufficiently to serve as initial type testing. This work shall be validated by the approved bodies for the purpose of certification of conformity.

Initial inspection and continous surveillance, assessment and approval of the factory and the factory production control
Notified bodies shall conduct initial inspection of the factory in order to ensure that the manufacturer has acceptable premises, technical equipment, qualified personnel and a factory production control system which is in accordance with the provisions in the ETA Guideline N° 011 and this ETA.

The notified body shall visit the factory at least twice a year for regular inspection. It must be verified that the factory production control is performed in conformity with the manufacturer's quality plan, including tests of samples according to the prescribed test plan.

Certification
The notified body shall issue a certification of conformity with this European Technical Approval when the provisions of the approval is fulfilled.

3.3 CE marking

CE marking shall be affixed on each beam. The CE marking shall be accompanied by the following information:

- name of the producer and the manufacturing plant
- product name and type according to Annex 1
- number of the ETA
- identification number of the notified certification body
- number of the EC certificate of conformity
- last two digits of the year in which the marking was affixed

4 Assumptions under which the fitness of the product for the intended use was favourably assessed

4.1 Manufacturing

Ranti beams are assembled in the factory by use of semi-automatic hydraulic presses. Before assembly the machine graded flange material is additionally graded visually according to specific grading rules endorsed by the approval body. Gluing of flanges to web and of web joints are performed according to specific provisions endorsed by the approval body. These provisions are based on relevant standards for structural gluing of wood material.

4.2 Installation

Ranti beams shall be installed on the basis of a specific structural design for each installation, using the load-bearing capacities given in Annex 2 of this ETA.

Actions at beam supports shall not exceed the bearing strength given in Annex 3.

The beams shall be installed by appropriate qualified personnel, following an installation plan and relevant construction details worked out for each individual building project. The installation plan shall be based on the manufacturers general guide and provisions for installing Ranti beams.

Holes in the beams to provide openings for ducts, pipes etc. must only be made in the web, after the load bearing capacity has been checked. The rules for web openings given in Annex 4 may be used if more accurate calculations are not made.

5 Recommendations for the manufacturer

5.1 Recommendations on packaging, transport and storage

The beams must be protected against harmful wetting during transport and storage.

The beams must not be lifted or stored in such a way that bending around the weak axis may cause damage to the beams.

5.2 Recommendations on use, maintenance, repair

It is the responsibility of the manufacturer to ensure that proper information for the use of Ranti beams is available at each delivery, including general guidance on the basis of this ETA.

SINTEF Building and Infrastructure
Oslo, 31.05.2010

Annex 1

Description of Ranti beams

Cross sections, sizes and moisture content

Ranti beams are manufactured in three standard types:
- Type IB – Standard beams
- Type IN – Beams with larger flange width
- Type IS – Studs

The beam profiles are shown in Fig. 1. Type IB and IS have the same cross sections, but Type IS has flange and web material with lower strength and stiffness characteristics.

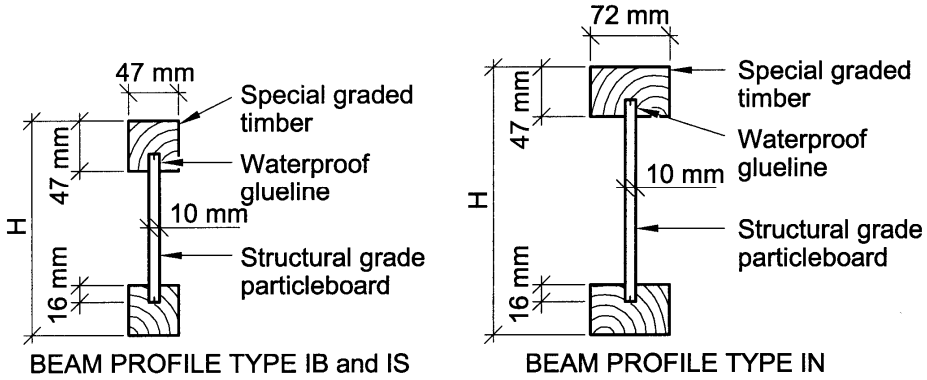


Fig. 1
Standard cross sections of Ranti beams

Standard beam depths (H) range from 200 mm to 600 mm. Maximum length is 12.4 m.

Size tolerances, measured at moisture content equivalent to 17 % in the flanges:

Overall beam depth H:	± 1 mm
Flange width and depth:	± 1 mm
Web thickness:	± 0,5 mm

Maximum moisture content by the time of assembly is 18 % for the timber flanges and 10 % for the web boards.

Specifications of components

Flanges

The flange timber is fingerjointed structural timber made from Nordic spruce with a mean density > 450 kg/m³. The timber is machine graded with additional visual grading of the final dimensions according to special grading rules made for the flange material. The grading is setup to meet the strength and stiffness values specified in Annex 2, Table 1. The flange material may be delivered from several manufacturers, but must always be certified by a notified body in accordance with the strength and stiffness values specified in this ETA.

Web

The particleboard used as web material is specially manufactured by Forestia AS, Norway. Boards for Ranti beams Type IB and IN are produced in accordance with EN 312-7, and for Ranti beams Type IS in accordance with EN 312-5. In both cases the boards must have an

Annex 1
(continued)

increased characteristic shear strength equivalent to the values given in Table 1. Board density is > 600 kg/m³.The board material is scarfjointed to match the full length of the beams, and shall be certified seperately according to EN 13986 by a notified body.

Glue
The flange/web connection, web joints and the flange fingerjoints are glued with a structural phenol-resorcinol formaldehyde adhesive, type I according to prEN 301:2001.

Annex 2

Mechanical properties of the beams and columns

Table 1 shows the characteristic strength and stiffness material properties for Ranti beams.
Table 2 shows characteristic strengt capacities for standard cross sections.
Table 3 shows stiffness values for standard cross sections.

The data in Table 2 and 3 are based on the characteristic strength properties and stiffness values given in Table 1, which also may be used to calculate non-standard cross section dimensions. Calculation of mechanical properties for special beam cross sections shall be done by the manufacturer, using the calculation method approved by the approval body and applied for Table 2 and 3 in this ETA.

Table 1
Characteristic strength and mean stiffness values in N/mm² for section member materials of Ranti beams

Property		Profile	
		Type IB and IN	Type IS
Bending strength, - flanges	f_{mk}	29	18
Tensile strength, - flanges	f_{t0k}	24	11
Compression strength, - flanges	f_{c0k}	27	16
Shear strength, - web	f_{vsk}	8,8	6,5
Shear strength, - web/flange joint	f_{vpk}	4,0	3,0
Modulus of elasticity*, - flanges, axial loads	E	13000	8700
Modulus of elasticity*, - web, axial loads	E	3000	1850
Shear modulus*, - web	G	1300	1000

* Mean value. For calculation of stability at ultimate limit state $E_{0,05} = 0,7 \cdot E$

Modification factors given in Table 4 and 5 as defined in EN 1995-1-1:2004 shall be applied for calculating design values at ultimate and serviceability limit state if no other values are specified as nationally determined parameters.

Annex 2
(continued)

Table 2
Characteristic strength capacities of Ranti beams

Profile	Bending moment kNm [1) 2)]		Axial compr. kN [2)]	Axial tension kN	Shear [3)] kN
	M_{xk}	M_{yk}	N_{ck}	N_{tk}	V_k
Type IB					
IB 200	7,6	1,0	116	99,3	16,6
IB 220	8,7	1,0	118	99,3	18,1
IB 250	10,6	1,0	119	99,3	20,3
IB 300	13,3	1,0	122	99,3	24,1
IB 350	16,0	1,0	125	99,3	27,9
IB 400	18,7	1,0	128	99,3	31,7
IB 450	21,5	1,0	131	99,3	34,9
IB 500	24,3	1,0	134	99,3	34,4
IB 550	27,2	1,0	137	99,3	34,0
IB 600	30,2	1,0	140	99,3	33,7
Type IN					
IN 200	11,7	2,4	175	156	20,4
IN 220	13,5	2,4	176	156	21,6
IN 250	16,3	2,4	178	156	23,4
IN 300	20,5	2,4	181	156	26,4
IN 350	24,6	2,4	184	156	29,4
IN 400	28,7	2,4	187	156	32,5
IN 450	32,9	2,4	190	156	34,9
IN 500	37,2	2,4	193	156	34,4
IN 550	41,5	2,4	196	156	34,0
IN 600	45,8	2,4	199	156	33,7
Type IS					
IS 170	3,0	0,6	68	45,5	10,3
IS 200	3,7	0,6	69	45,5	12,2
IS 220	4,2	0,6	70	45,5	13,5
IS 240	4,6	0,6	70	45,5	14,8
IS 250	4,9	0,6	71	45,5	15,5
IS 300	6,1	0,6	72	45,5	18,7

1) Bending around the stiff axis X and the weak axis Y
2) Provided the compression flange is laterally braced at points spaced ≤ 350 mm for IB- and IS profiles, and ≤ 600 mm for IN-profiles.
3) Beams shall be stiffened to avoid web buckling under large concentrated loads.

Table 3
Stiffness values and radius of gyration of Ranti beams[1)]

Profile	Bending stiffness[2)] kNm^2		Axial stiff-ness kN·10^3	Shear stiff-ness kN·10^3	Radius of gyration mm	
	EI_x	EI_y	EA	GA	i_x	i_y
Type IB						
IB 200	339	10,6	57,8	1,74	76,6	13,5
IB 220	431	10,6	58,4	2,00	85,9	13,5
IB 250	591	10,6	59,3	2,39	99,9	13,4
IB 300	917	10,6	60,8	3,04	122,8	13,2
IB 350	1320	10,6	62,3	3,69	145,5	13,0
IB 400	1800	10,6	63,8	4,34	167,9	12,9
IB 450	2360	10,6	65,3	4,99	190,1	12,8
IB 500	3000	10,6	66,8	5,64	211,9	12,6
IB 550	3720	10,7	68,3	6,29	233,5	12,5
IB 600	4540	10,7	69,8	6,94	254,9	12,4
Type IN						
IN 200	524	38,0	88,4	1,74	77,0	20,7
IN 220	666	38,0	89,0	2,00	86,5	20,7
IN 250	912	38,0	89,9	2,39	100,7	20,6
IN 300	1410	38,0	91,4	3,04	124,3	20,4
IN 350	2030	38,0	92,9	3,69	147,7	20,2
IN 400	2760	38,1	94,4	4,34	170,9	20,1
IN 450	3600	38,1	95,9	4,99	193,9	19,9
IN 500	4570	38,1	97,4	5,64	216,7	19,8
IN 550	5660	38,1	98,9	6,29	239,3	19,6
IN 600	6880	38,1	100,4	6,94	261,8	19,5
Type IS						
IS 170	149	7,1	37,9	1,04	62,7	13,7
IS 200	227	7,1	38,5	1,34	76,8	13,6
IS 220	288	7,1	38,8	1,54	86,1	13,5
IS 240	357	7,1	39,2	1,74	95,5	13,4
IS 250	395	7,1	39,4	1,84	100,1	13,4
IS 300	612	7,1	40,3	2,34	123,2	13,3

1) For caculation of stability at ultimate limit state the stiffness values shall be multiplied with the factor 0,7
2) Bending around the stiff axis X and the weak axis Y

Annex 2
(continued)

Table 4
Modification factor k_{mod} for Ranti beams

Load-duration class	Bending and axial capacity	Shear capacity			
	All profiles	Type IB and IN		Type IS	
	Service class 1 and 2	Service class		Service class	
		1	2	1	2
Permanent	0,60	0,40	0,30	0,30	0,20
Long-term	0,70	0,50	0,40	0,45	0,30
Medium-term	0,80	0,70	0,55	0,65	0,45
Short-term	0,90	0,90	0,70	0,85	0,60
Instantaneous	1,10	1,10	0,90	1,10	0,80

Table 5
Deformation factor k_{def} for Ranti beams

Bending and axial deformation		Shear deformation			
All profiles		Type IB and IN		Type IS	
Service class		Service class		Service class	
1	2	1	2	1	2
0,60	0,80	1,50	2,25	2,25	3,00

Annex 3

Bearing capacity at supports

The characteristic bearing capacity for Ranti beams at beam supports F_k is calculated according to the following formula:

$F_k = 2 \cdot d \cdot l_f \cdot f_{v90k}$

where

d = 16 mm (glueline depth)

$l_f = b + n \cdot h_f / C_f$

where

b = support width

n = distribution factor according to Table 6

h_f = 47 mm at compression, 40 mm at tension

C_f = stress factor according to Table 6

$f_{v90k} = 0{,}85 \cdot f_{vpk} = 3{,}4$ N/mm² at compression

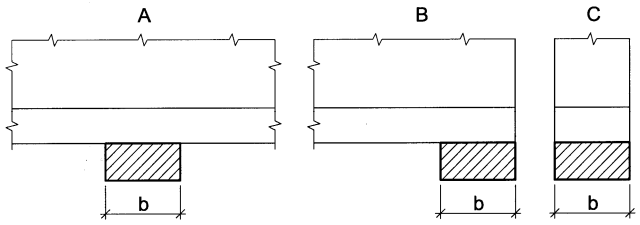
$f_{v90k} = 0{,}45 \cdot f_{vpk} = 1{,}8$ N/mm² at tension

where

f_{vpk} = web/flange shear strength, see Table 1 of the approval

Table 6

Type of support	n	C_f
A	2	0,80
B	1	1,25
C	0	1,00



Type of support

The design support bearing capacity F_d is calculated as follows:

$F_d = F_k \cdot k_{mod}$

where k_{mod} is the value for bending and axial capacity shown in Annex 2, Table 4.

For beam heights > 220 mm the support bearing capacities shall be multiplied by the following reduction factor k_s if a concentrated load is placed on top of the beam directly over the support:

$k_s = 225 / H$

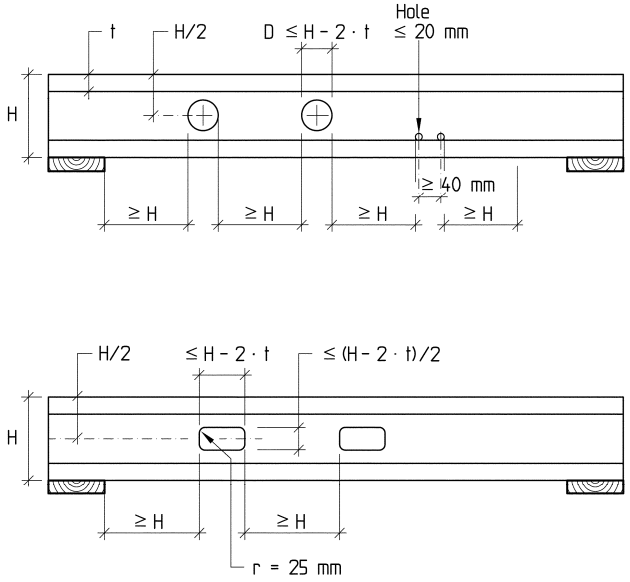
where

H = beam height

Annex 4

Holes in beams

Holes in Ranti beams must only be taken in the beam web, applying the following rules:



The shear capacity in sections with holes shall be multiplied with the factor
$k = \frac{H-47-0,9D}{H-47}$,
where H and D are in mm, and D is the hole diameter or the largest side in rectangular holes.

- Holes shall be positioned at the center of the web, apart from small holes with diameter ≤ 20 mm
- Rectangular holes may have a height of max. H – 2·t when the width is ≤ 150 mm
- Characteristic shear capacity in sections with rectangular holes shall never exceed 4 kN regardless the beam height