SINTEF Technical Approval

TG 20436

SINTEF
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Provided listed on
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SINTEF confirms that

Gokstad Hus building system

has been found to be fit for use in Norway and to meet the provisions regarding product documentation given in the regulation relating to the marketing of products for construction works (DOK) and regulations on technical requirements for building works (TEK), with the properties, fields of application and conditions for use as stated in this document

1. Holder of the approval

SIA Gokstad Hus
Rīgas iela 6
Olaine, Olaines novLV-2114
Latvia

2. Product description

2.1 General

Gokstad Hus building system are factory-manufactured building elements that are assembled at the construction site *(e.g. residential buildings, office buildings, school buildings, etc.)*. The scope of use is specified in more detail in section 3.

The approval covers prefabricated exterior and interior wall elements, elements for floor divisions and roof elements. The elements are based on a support system with wooden studs and wooden beams.

2.2 Scope of approval

The approval covers the execution at the factory of the standard design system with associated materials and components as specified in section 2.3. This includes the elements' wall structures, floor dividers and roof with associated construction details, as well as details for joining elements.

The materials listed in Table 2 are assembled at the construction site and are not covered by the approval. These materials have been specified in order to evaluate that the properties of the finished construction are as specified in section 4, and that the standard construction details are in accordance with SINTEF's recommendations. The approval also does not cover surface treatments inside and outside nor windows and doors. These materials and components shall be specified and documented separately for each construction project in accordance with the Regulations on the Sale and Documentation of Construction Products (DOK), and be CE marked where required by regulations.

Nor does the approval covers inspection of installation at the construction site nor supplementary building structures in the individual construction project, including technical installations such as ventilation systems, heating systems nor electrical installations.

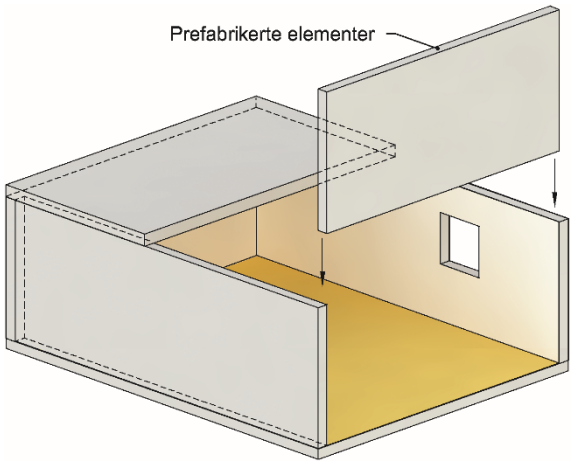


Fig. 1
Principal Gokstad Hus building system

2.3 Construction details and general design

The specification of the individual materials and components is shown in Table 1. The properties of these must be documented from the respective suppliers. Products specified with SINTEF Technical Approval must be used in accordance with what is stated in the separate approval.

The principal structure of floors, walls and ceilings are shown in Fig. 2– 7. Detailed execution of the elements and associated joining details are described in "Standard design details for Gokstad Hus building system belonging to SINTEF Technical Approval No. 20436". The version of the construction details that is archived at SINTEF at any given time forms a formal part of the approval. Detailed design of properties and performance of the structures shall be carried out in each individual construction project in accordance with sections 4 and 6

Table 1
Gokstad Hus building system material specifications

Material/Component	Specification[1)]	MS/PS [2)]	Fire-classification [3)]	CE marking [4)]
Load-bearing components				
Wood	Construction timber with from Holmen Wood, Lotus Timber, Pata Saldus, Raitwood , Stora Enso Eesti, strength class C24, or according to specific dimensioning. Moisture content max. 18%, no tropical wood		D-s2,d0-	EN 14081-1
	CU impregnated timber from Baltic wood trading SIA, Lotus timber OU, Pata, Saldus AS, Raitwoos			
Glulam	Glulam from Peetri Puit with strength class GL32 or according to specific dimensioning Formaldehyde class E1		D-s2,d0--	EN 14080
Steel	Steel post and beams according to specific structural calculation, S235, S275 or S355			EN 10025
Beams	Construction timber from Holmen Wood, Lotus Timber, Pata Saldus, Raitwood, Stora Enso Eesti with strength class C24		D-s2,d0--	ETA-06/0238
	Products with SINTEF Technical Approval for the relevant application			EN 14081-1
Building boards				
Subfloor	Products with SINTEF Technical Approval for the relevant application			
	12.5 mm Norgips floor S plasterboard type DFIR		A2-s1,d0	EN 520
Wind barrier plates	Products with SINTEF Technical Approval for the relevant application		-	-
	9 mm Gyproc GTS type EH2		A2-s1,d0	EN 520
	9 mm Norgips GU type EH2		A2-s1,d0	EN 520
Roofpanels	Products with SINTEF Technical Approval for the relevant application			
Cladding				
Exterior cladding	19 mm cladding table class A		D-s2,d0	EN 14915 SN/TS 3186
	19 mm coated wood paneling from Raitwood, coating from Teknos, Nordica EKO		D-s2,d0	EN 14915
	Aquapanel, Knauf		A1	ETA 07/0173
Metal sills and flat sheets	Ruukki polyester or epoxy coated facade matal sills and flashing			EN 14783
Interior cladding	Products with SINTEF Technical Approval for the relevant application			
	12.5 mm Rigips Pro Hydro plasterboard Type H2		A2-s1,d0-	EN 520-
	15 mm Rigips Pro Fire plasterboard Type DF		A2-s1,d0	EN 520
	12.5 mm Rigips Pro plasterboard Type A		A2-s1,d0	EN 520
	12.5 mm Norgips GKB plasterboard Type A		A2-s1,d0	EN 520
	12.5 mm Norgips GKBI plasterboard Type H2		A2-s1,d0	EN 520
Insulation materials				
Insulation	Isover standard mineral wool , λ_D =35 W/mK		A1[5)]	EN 13162
	Isover premium mineral wool , λ_D =333 W/mK		A1	EN 13162
Barriers				
Windbarrier	Products with SINTEF Technical Approval for the relevant application			
Subroofing	Products with SINTEF Technical Approval for the relevant application			
Vapor barrier	Products with SINTEF Technical Approval			
Fasteners				
Tape	Products with SINTEF Technical Approval for the relevant application			
Sealants	Soudal Fix ALL Flexi			EN 15651
	Soudal Vapour seal			
	Isover SK-C Thermal insulation		A2-s1,d0	EN 13162
Nails / screws	Screws, nails and fittings for fastening exterior cladding, anchoring and the like must be hot-dip galvanized, or have corresponding corrosion protection from Essve, Rothoblass, Eurotec, Marcopol			EN 14592 EN 14566
Various				
Windows/doors	Windows and doors are not part of the approval, but the products installed in the elements must satisfy requirements for thermal insulation and tightness as stated in the Building Technology Regulations (TEK).			

[1)] Unspecified material dimensions shall be as specified in the "Standard Construction Details" or as designed specifically for each individual construction project
[2)] The product has a SINTEF Environmental Certificate (MS) or SINTEF Product Certificate (PS)
[3)] Fire classification according to EN 13501-1, for use according to "Standard construction details"
[4)] The component shall be CE marked according to the specified product standard or ETA
[5)] For building elements that must have fire resistance, see chap. 6 Terms of Use

Table 2
Specifications of materials assembled at the construction site

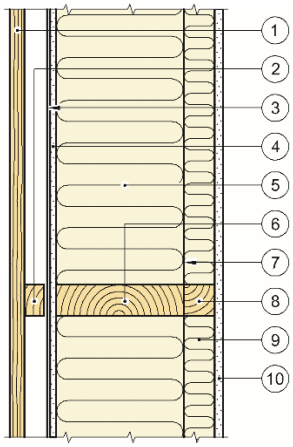
Material	Specification [1)]	MS/PS [2)]	Fire-classification [3)]	CE-marking [4)]
Interior cladding	- 12.5 mm plasterboards type A		A2-s1,d0	EN 520
	- 15 mm plasterboards type DF		A2-s1,d0	EN 520
Insulation	- Glass wool with min. density. 15 kg/m^3		A1	EN 13162
	- Stone wool with min. density. 26 kg/m^3		A1	EN 13162
Vapour barrier	Products with SINTEF Technical Approval for the relevant application		-	EN 13984-
Roof coverings			B_{ROOF}(t2)	

[1)] Unspecified material dimensions shall be as specified in the "Standard Construction Details" or as designed specifically for each individual construction project

[2)] The product has a SINTEF Environmental Certificate (MS) or SINTEF Product Certificate (PS)

[3)] Classification of properties of reaction-to-fire according to EN 13501-1 using according to "Standard construction details"

[4)] The component shall be CE marked according to the specified product standard or ETA



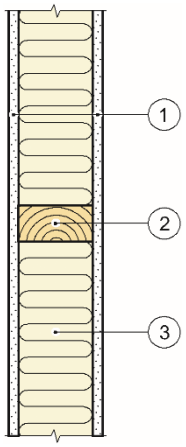
1	External cladding	6	Framework cc 600 mm with insulation 45x145/195/…/
2	25 x 50 mm battens or 25x50 + 45x45cross battens	7	Vapour barrier
3	Wind barrier	8	45 mm battens
4	9.5 plasterboard	9	50 mm insulation
5	Min. 150 mm Insulation	10	Internal Lining

Fig. 2
Horizontal section principal construction of external walls

Exterior walls are adapted to each project and come with exterior cladding, wind barrier, insulation, vapour barrier, battens with windows and doors installed in the factory. Application and internal lining and insulation are normally installed at the construction site. The exterior wall elements are adapted to each spesific project.

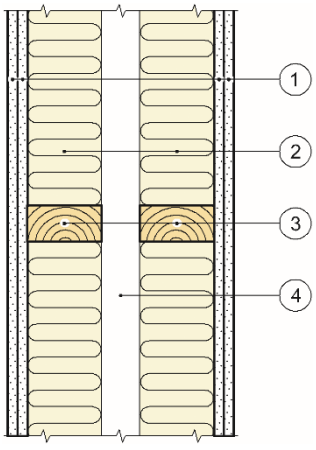
Internal walls are, depending to the project, delivered from factory only with framework or with single or double-sided lining and insulation

Elements for apartment partitions are delivered from factory with framework only as standard. Elements can be delivered with insulation and partly lining.



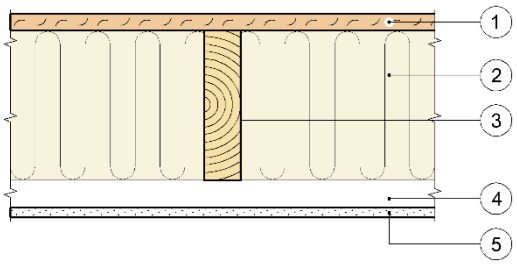
1	Interior lining
2	Framework cc 600 mm
3	Min. 100 mm insulation

Fig. 3
Horizontal section, principal construction of interior walls



1	Interior lining	3	Framework cc 600 mm
2	Min. 75 mm insulation	4	Minimum 30 mm cavity

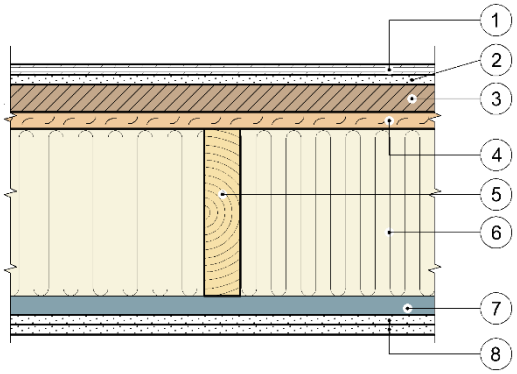
Fig. 4
Horizontal section principal construction of partitions between apartment partitions



1	OSB	4	25x50 latch
2	Insulation	5	Ceiling lining
3	Joists		

Fig 5
Vertical principal structure section floor inside housing unit

Floor dividers are supplied as open beams of composite beams, construction timber or I-beams with mounted OSB, insulation and latches. Ceiling lining is mounted at construction site.



1	Flooring	5	Joist
2	12.5 mm plasterboard	6	Insulation
3	36 mm wood fibre boards	7	Acoustic profile
4	22 mm OSB	8	Ceiling lining

Fig 6
Vertical section principal structure floor between housing units

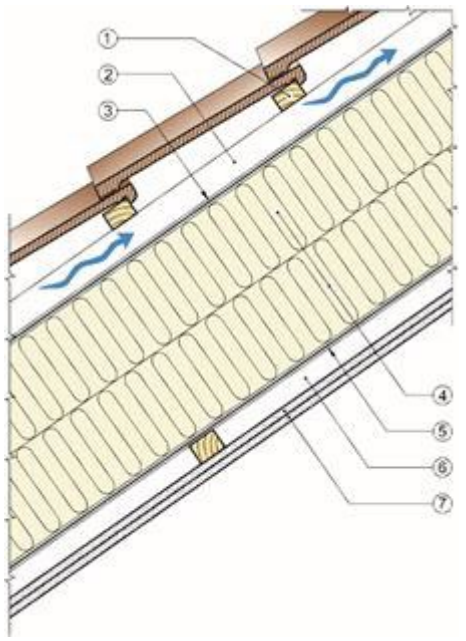
Floor dividers are supplied as open beams of composite beams, construction timber or I-beams with mounted OSB, insulation and latches, acoustic profiles. Ceiling lining is mounted at construction site.

3. Fields of application

Application of elements must always be checked by the responsible company. Gokstad Hus building system are considered to satisfy pre-accepted performance for buildings in risk class 1-6 in fire class 1, as well as housing up to 3 floors if each housing unit has direct access to terrain without needing to escape via stairs or stairwells as given in the guidelines to TEK

The use of Gokstad Hus building system in fire classes and risk classes other than those specified herein has not been assessed by SINTEF and must be documented separately by the responsible company in each individual construction project.

Before selecting Gokstad Hus building system for use in a project, it must also be checked whether the project has requirements for stricter or different performances than those pre-accepted.



1	Battens	5	vapour barrier
2	Ventilation battens	6	battens
3	sub roof	7	Internal lining
4	Rafters and insulation		

Fig 7
Vertical section principal structure roof construction

Elements are delivered from factory with laths, sub roof, insulation, vapour barrier and battens. Ceiling lining is done on site.

4. Properties

4.1 Load carrying capacity

Load capacity of load-bearing structures is calculated specifically for each individual delivery as specified in section 6.2.

4.2 Safety in case of-fire

The fire safety class according to EN 13501-1 for products included in *Gokstad Hus building system* is given in Table 1.

4.3 Fire resistance

The fire resistance of the building components is given in Table 3. The fire resistance is determined based on calculation methods according to the manual Brandsäkra Trähus version 3 and EN 1995-1-2:2004. The declared fire resistance assumes the specified structure given in Figures 2-7, "S*tandard design details for Gokstad Hus building system belonging to SINTEF Technical Approval No.20436*" and materials as given in Table 1.

For structures not mentioned in Table 3, fire resistance must be calculated in accordance with the handbook Brandsäkra Trähus version 3 and EN 1995-1-2:2004, or relevant SINTEF Building Research Design Guides.

Fire resistance applies to one-sided fire exposure from the inside for external walls, and from underneath for floor dividers/roofs. For interior walls, fire resistance applies to one-sided fire exposure, unless otherwise specified in Table 3.

The dimensioning load capacity for walls in the accident boundary condition fire is given as the maximum centric axial load per metre of wall (kN/m with c/c 600 mm between studs). Fire dimensioning capacity for floor dividers with single span and roof is given as maximum bending moment (kNm) per beam. Where Full capacity is stated, this means that no charring will occur on the timber structure during the fire exposure time because the cladding protects the structure. Dimensioning capacity in the break or use limit will therefore be dimensional.

Table 3
Fire resistance of building elements with fire cell limiting and/or load-bearing properties

Building part	Fire resistance equivalent to [1)]	Dimensioning load or torque capacity in case of fire[2)]
Exterior walls, fig. 2		
Internal cladding 12.5 mm plasterboard type A	REI 15	Full capacity
Internal cladding 2 x 12.5 mm plasterboard type A	REI 30	Full capacity
Inner walls, load bearing (and separating) Fig.3.[3)]		
Cladding 12.5 mm plasterboard type A on both sides	R 15	Full capacity
Cladding 2 x 12.5 mm plasterboard type A on both sides	R 30	Full capacity
Apartment partitions, fig. 4[4)]		
Cladding 2 x 12.5 mm plasterboard type A on both sides	REI 30	Full capacity
Floor divisions within housing unit, fig. 5		
Cladding 12.5 mm plasterboard type A	R 15	Full capacity
Cladding 2 x 12.5 mm plasterboard type A	R 30	Full capacity
Floor divisions between different housing units, fig. 6		
Cladding 2 x 12.5 mm plasterboard type A	REI 30	Full capacity
Roof, Fig. 7		
Internal cladding 12,5 mm plasterboard type A	REI 15	Full capacity
Cladding 2 x 12.5 mm plasterboard type A	REI 30	Full capacity

[1)] Fire resistance equivalent to classification according to EN 13501-2. Wall height max 2.4 m.
[2)] Dimensioning capacity of the building components after 15 and 30 minutes fire exposure.
[3)] Fire exposure both sides.
[4)] Capacity for each wall part.

4.4 Sound insulation
With partition structures as shown in section 2 and joining between building parts as specified in "*Standard design details for Gokstad Hus building system belonging to SINTEF Technical Approval No. 20436*", are expected sound insulation properties according to NS-EN ISO 16283-1 and -2 as well as NS-EN ISO 717-1 and -2 as specified in Table 3 for finished houses. The values correspond to sound class C according to NS 8175.

Table 4
Expected sound insulation in finished houses

Construction	Air sound insulation R'w	Stepping sound insulation L'n,w
Floor divisions between apartments (fig. 6)	≥ 55 dB	≤ 53 dB
Partition between apartments (fig. 4)	≥ 55 dB	≤ 53 dB

The values satisfy the minimum requirements for sound insulation between homes in accordance with the guidelines to TEK, i.e. sound class C in accordance with NS 8175 without conversion figures for extended frequency range/low-frequency sound. In order to satisfy SINTEF's recommended requirements for sound insulation between dwellings, supplementary measures must be taken, see the Norwegian Building Research Institute series 522.511 *Soundproofing floor dividers with wooden beam layers in dwellings*. Sound insulation also depends on the installation of technical installations, which must be considered in each individual construction project.

4.5 Thermal insulation
Table 5 shows the heat transfer coefficients, U-value, for standard building components as described in section 2, calculated in accordance with EN ISO 6946. The exterior wall value is based on a timber frame of 17% and does not include heat loss due to extra wood around door and window openings. See also section 6.5 on design of thermal insulation. The thermal conductivity of the insulation is 0.035 W/mK.

Table 5
Thermal insulation coefficients, U-value

Building part	Insulation thickness mm	U-verdi W/m²K
Exterior wall (fig. 2)		
45x145 mm + 45x45 mm	200	0.22
45x195 mm + 45x45 mm	250	0.18
Roof (fig. 7)		
45x195 mm	200	0.21
45x245 mm	250	0.17
45x245+45x95	350	0,13

4.6 Durability
The design of the elements satisfies the general requirements recommended by SINTEF with regard to the tightness and durability of the climate shell.

5. Environmental aspects

5.1 Chemicals hazardous to health and the environment
The products included in the elements contain no priority hazardous substances or other relevant substances in quantities considered hazardous to health and the environment. Priority hazardous substances include CMR, PBT and vPvB substances.

5.2 Indoor climate impact
The elements are evaluated according to SINTEF Technical Approval – Health and Environmental Requirements version 09.05.2022. The product is not regarded as emitting any particles, gases or radiation that have a perceptible impact on the indoor climate, or to have any significant impact on health. The product meets the requirements in BREEAM-NOR v6.0, Emissions from building products according to Hea 02 Indoor air quality.

5.3 Waste management/reuse possibilities
The elements contain no hazardous substances and is assessed as non-hazardous waste according to Norwegian Waste regulations (Avfallsforskriften). The product shall be delivered to an authorized waste treatment plant for material recovery, energy recovery or disposal according to recommendations from the Manufacturer`s

5.4 Environmental product declaration
No Environmental Product Declaration (EPD) has been prepared for Product Gokstad Hus building system.

6. Special conditions for use and installation

6.1 Products with SINTEF Technical Approval and Product Certificate
Products with SINTEF Technical Approval and Product Certificate included in the elements shall be used in accordance with the respective product approvals.

6.2 Structural capacity design
All load-bearing components in elements shall be dimensioned specifically in accordance with EN 1995-1-1 *(for timber structures)* with associated national supplement NA for each construction project and delivery. Cargoes shall be determined in accordance with NS-EN 1991-1 and associated National Amendment NA.

For small houses and smaller buildings, the dimensioning can usually also be done with reference to relevant SINTEF Building Research Design Guides.

Beam layers in floor dividers must also be dimensioned in accordance with the stiffness criteria in the SINTEF Building Research Design Guide 522.351 *Wooden beam layer. Dimensions and execution.*

6.3 Safety in case of fire
For each individual delivery, the necessary fire resistance according to TEK must be determined for building parts that are to have load-bearing and/or fire cell limiting properties in the event of fire. Dimensioning load/torque capacity in the event of an accident threshold fire must be checked by checking design capacities as specified in Table 2 against the performing dimensioning load. The choice of structure is made based on the need for fire resistance.

The choice of products for interior and exterior surfaces, in cavities behind exterior cladding, insulation, etc. must be based on pre-accepted benefits given in the guidelines to TEK. The need for measures to prevent fire spread in the façade must be considered in each project.

Board cladding is installed in accordance with the supplier's installation instructions and the SINTEF Building Research Design Guide 543.204 *Installation of plaster and fibreboard on walls and ceilings*.

Penetrations and routes in building parts with fire resistance, as well as transitions to other building parts, must be carried out in such a way that they do not weaken the fire resistance of the building part. See the SINTEF Building Research Design Guide520.342 *Fireproofing of penetrations*.

6.4 Design of sound conditions in buildings with several residential units
For use in buildings with several residential units, the elements shall be carried out with floor dividers and supporting external and internal walls adapted to reduced sound transmission as specified in "*Standard construction details for Gokstad Hus building system belonging to SINTEF Technical Approval No. 20436*".

Against all walls and penetrations, elastic terminations and transitions must be established.

In general, care should be taken when laying penetrations for water pipes, ventilation ducts or other installations in soundproofing partition structures.

6.5 Design of thermal insulation
For each individual delivery, the necessary energy efficiency according to TEK must be designed for the construction project in question. The U-values specified in section 4.5 can be used for control of minimum requirements in TEK. Calculation of total heat loss for each building is done with a specific calculation program.

6.5Foundation
elements shall be placed on a foundation that satisfies the manufacturer's requirements for flatness and dimensional tolerances.

Moisture absorption in the elements from the building's foundations must be prevented by moisture barrier. It is assumed that the foundation satisfies the principles for ventilation under the elements shown in the Building Research series' instructions.

6.7 Montage
The elements shall be assembled in accordance with the design details in "*Standard design details for Gokstad Hus building system belonging to SINTEF Technical Approval No. 20436*", and specific assembly details prepared for each construction project.

6.8Transportation and storage
The elements shall be protected against precipitation during transport and storage with a waterproof thatch or packaging. Also during transport and storage, the elements must be placed on a level surface with support so that the elements do not suffer harmful deformations.

7. Factory production control

The elements in Gokstad Hus building system are manufactured by SIA Gokstad Hus, Rīgas iela 6, Olaine, Olaines nov., LV-2114, Latvia.

The holder of the approval is responsible for the factory production control in order to ensure that the product is manufactured in accordance with the preconditions applying to this approval.

The manufacturing of the product(s) and the manufacturer's system for factory production control (FPC) is subject to continuous surveillance in accordance with the contract regarding SINTEF Technical Approval.

SIA Gokstad Hus has a quality system certified by Det Norske Veritas GL according to ISO 9001. Certificate No. 201095-206-AQ-LVA-FINAS

8. Basis for the approval

The approval is based on the assessment of the overall construction design, the properties of the materials and components used in the standard element design, and on performances documented in specific test reports and calculations.

9. Marking

Each delivery of the elements must be accompanied by delivery documents containing at least the manufacturer's name and address, project identification and assembly specifications for the construction project in question. The design details shall be in accordance with the details in "*Standard design details for Gokstad Hus building system belonging to SINTEF Technical Approval No. 20436*".

The approval mark for SINTEF Technical Approval TG 20436 may also be used.

10. Liability

The proprietor/manufacturer has the independent product liability in accordance with applicable law. Claims may not be submitted to SINTEF beyond those mentioned in NS 8402.

for SINTEF

Hans Boye Skogstad
Approval Manager