TECHNOLOGICAL CARD III: ROOF WORKS

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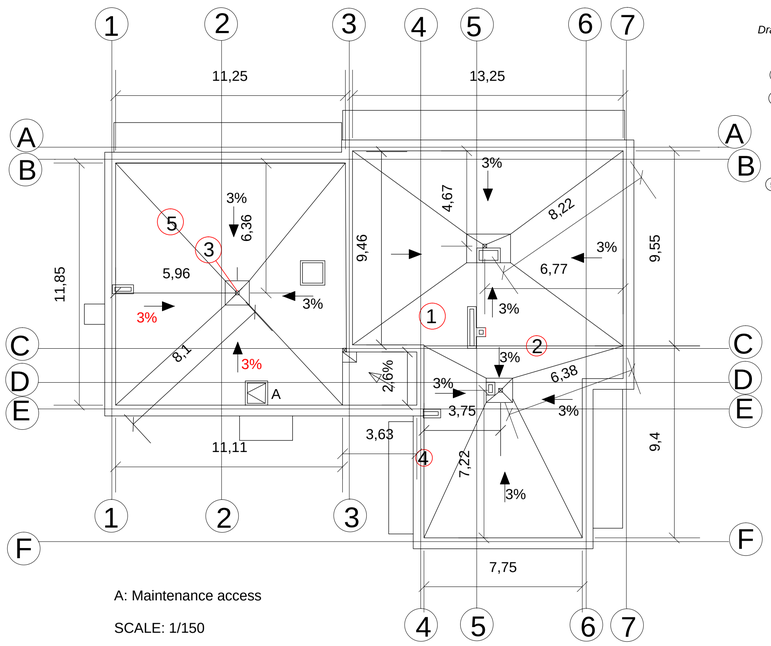
INTRODUCTION

In this technological card we are going to explain the roof works of the project. The top covering of the building is going to be formed by a non passable flat roof composed of 13 gables with pitches of 3% that have the purpose of picking up the rainwater to four points of the rainwater harvesting system. The roof can only be acceded form maintenance or repair. The total area horizontally projected of the roof is 348,3m2.

As there isn't information about the composition of the roof we have considered that the best option is gravel autoprotected asphaltic sheet as the top coating of the roof.

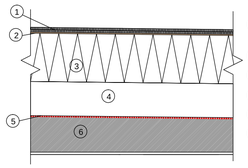
In this card we are going to study some problematic points that we must put attention to do it in a correct way so the roof makes perfectly its function keeping the waterproofing or thermal and noise insulation in the whole area of the roof.

ROOF'S AERIAL VIEW



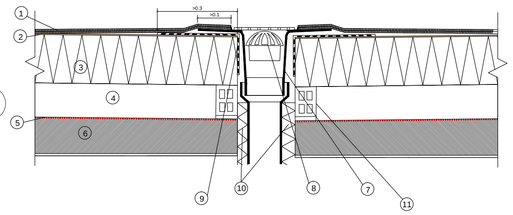
ROOF DETAILS:

General detail



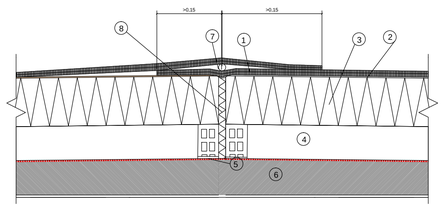
1. WATERPROOFING: 2 autoprotected asphaltic sheets
2. INTERLAYER: geotextile
3. INSULATION: mineral wool
4. PITCH: Cellular ligthweigth concrete
5. STEAM BARRIER: polyethylene
6. SUPPORT: Concrete slab

Drain detail



1. WATERPROOFING: 2 autoprotected asphaltic sheets
2. INTERLAYER: geotextile
3. INSULATION: Styrofoam 0.2m
4. PITCH: Cellular ligthweigth concrete 0.15m
5. STEAM BARRIER: polyethylene
6. SUPPORT: Concrete slab
7. DRAIN
8. COVER/PROTECTION
9. WATERPROOF REINFORCE: Elastomer
10. ACUSTIC INSULATION: Mineral wool
11. Ceramic Brick

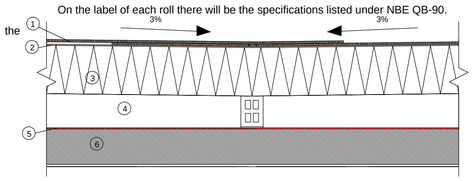
Ridge detail



1. WATERPROOFING: 2 autoprotected asphaltic sheets
2. INTERLAYER: geotextile
3. INSULATION: Styrofoam
4. PITCH: Cellular ligthweigth concrete
5. STEAM BARRIER: polyethylene
6. SUPPORT: Concrete slab
7. Elastic filler material
8. INSULATION/INTERLAYER: extended polystyrene

Valley detail

On the label of each roll there will be the specifications listed under NBE QB-90.



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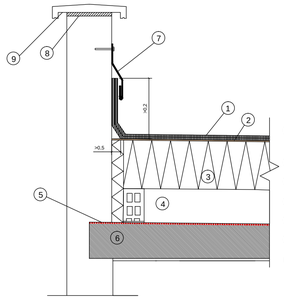
Roof and wall detail



1. WATERPROOFING: 2 autoprotected asphaltic sheets
2. INTERLAYER: geotextile
3. INSULATION: Styrofoam
4. PITCH: Cellular ligthweigth concrete
5. STEAM BARRIER: polyethylene
6. SUPPORT: Concrete slab
7. Waterproofing reinforcement of zinc
8. Waterproofing mortar
9. Stone cap

SEQUENCE OF WORKS:

1-PREPARE BASE: The first step is cleaning the surface of the support, it is important that there isn't oil, grease, paint or other impurities.

2-CONCRETE FORMWORK: Then we have to mark with ceramic bricks the gables, and the pitch. They will mark the hips and valleys of the roof and it will be used as the concrete formwork. When we finish we will remove the debris from bricks.

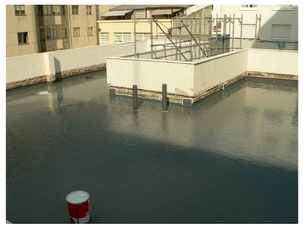
3-STEAM BARRIER: We will put the steam barrier composed of a polyethylene film.

4-PITCH FORMER: we can proceed to put on the cellular concrete as the pitch former. The cellular concrete will have a thickness of 20cm with a pitch of 3% and it will be mixed put by a pump located in the working zone

5-INSULATION:After the cellular concrete we will put on the thermal and acoustic insulation, mineral wool of 20cm

6-WATERPROOFING: Then we will put a geotextile to separate the insulation from the last layer, two autoprotected sheets composed of polymeric bitumen. These sheets have very good tension resistance, shear reinforcement and also very good performance in open sky. They will be stuck on the surface by a blowlamp.

7-WATERTIGHTNESS TEST: When the roof is finished we must do the watertightness test to guarantee the perfect performance of the roof. It will consist in closing the drains and flooding the roof 5cm with water by 24 hours. After the time has finished there will be an inspection or the lower plane of the slab and the walls that close it. In case that the test is rejected, it will be repaired and we will repeat the test again.



QUALITY CONTROL

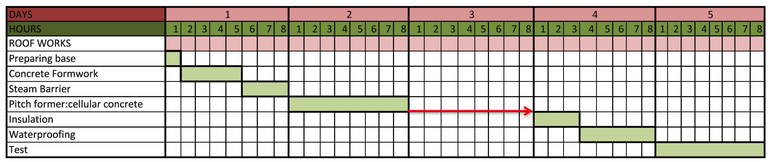
The roof works will be controlled to be executed according to the project. Apart from the execution there will be a control of the materials received in the construction. They would have the specific characteristics that the project asks. In the reception there will be a control to guarantee that all the elements have:

-The commercial brand.
-First quality marck (in case).
-Reference to the normative
-Nominal and manufacture dimensions.
-it is obligatory the european certificate CE mark.

AUTOPROTECTED SHEETS:
The sheets will be delivered in protected rolls from factory to prevent damage during transport and storage.
They will have a nominal minimum width of 1 meter. Differences between effective and nominal width won't be admitted, by default or by excess, in the order of 1%.
The minimum nominal length is 5meters and the effective length won't be less than the nominal.

ORGANIZATION OF WORKS

Team: 5Workers 0,323m2/h
Roof Area: 348,3m2



TECHNICAL-ECONOMIC INDICATORS:

		QUANTITY	UNITY PRICE	PRICE €
FORMWORK	DOUBLE AIR CERAMIC BRICK	140 U	0,13€/U	18,2
	CEMENT MORTAR	13,93m3	115,3€/m3	1606,135
STEAM BARRIER	POLYETHYLENE FILM	383.13m2	9,86€/m2	3777,66
PITCH	CELLULAR CONCRETE	34,43m3	59,5€/m3	2048,6
INSULATION	MINERAL WOOL	365,7m2	1,34€/m2	490,04
WATERPROOFING	AUTOPROTECTED ASPHALTIC SHEETS	766,26m2	10,42€/m2	7984,43
		TOTAL ROOF WORKS		**15925,07**

WORK	PERFORMANCE (h/m2)	AREA m2	Nº WORKER	HOURS (h/day)	DAYS
Preparing base	0,006	348	2	8	0,125
Concrete Formwork	0,023	348	2	8	0,5
Steam Barrier	0,02	348	2	8	0,375
Pitch former:cellular concrete	0,05	348	2	8	1
Insulation	0,02	348	2	8	0,375
Waterproofing	0,03	348	2	8	0,625

HUMAN SAFETY:

RISKS	CAUSES	INDIVIDUAL PROTECTION	COLLECTIVE PROTECTION	SAFETY MEASURES
Falls at different level	Absence of protection against falls on height.	Helmet	Gallow Net	The working area will be clean and tidy
Falls at same level	Break the roof by walking on non passable roof and don't walking on the footbridges.	Security gloves		There will be an area for storage
	Trickle by working on wet surface.	Boots		Footbridges for walking
Hitten by fallen objects	Bad or excessive storage.	Glasses		Don't work in bad weather conditions
	Leave tools around the roof.	Mask		Don't leave tools and objects around the roof
Cuts	Working with dangerous tools and materials.			
Electrification	working near electricity systems with any protection.			
Overstrain	Handling heavy objects and tools			
	Working in the same position for a long time			

	NAME	SIGNATURE	DATE	TITLE OF FINAL THESIS PROJECT	
STUDENT	Celia Chardi Perez			Daugiabučio gyvenamojo namo Žirmūnų g. 1L, Vilniuje, statybos projektavimas Construction planning of the residential building at Zirmunai str. 1L in Vilnius	
SUPERVISOR	Jonas Šaparauskas			PLAN NAME	NUMBER OF PLAN
HEAD OF DEPARTMENT	Edmundas Kazimieras Zavadskas			TECHNOLOGICAL CARD III: ROOF WORKS	4
				UNIVERSITY	DEPARTMENT
REVIEWER				VILNIAUS GEDIMINO TECHNIKOS UNIVERSITETAS	Department of Construction Technology and Managment