

# **NOTE DE CALCUL**

**Projet: 10608-NC1A\_2013**

**TOUR ECHAFFAUDAGE UP6**

**Désignation normative de la Tour UP6 : EN 1004-3-6/6-XBXX**

**Note de calculs référence :10608-NC1A\_2013.rtd**

**du: 28/11/13**

**B.E:**



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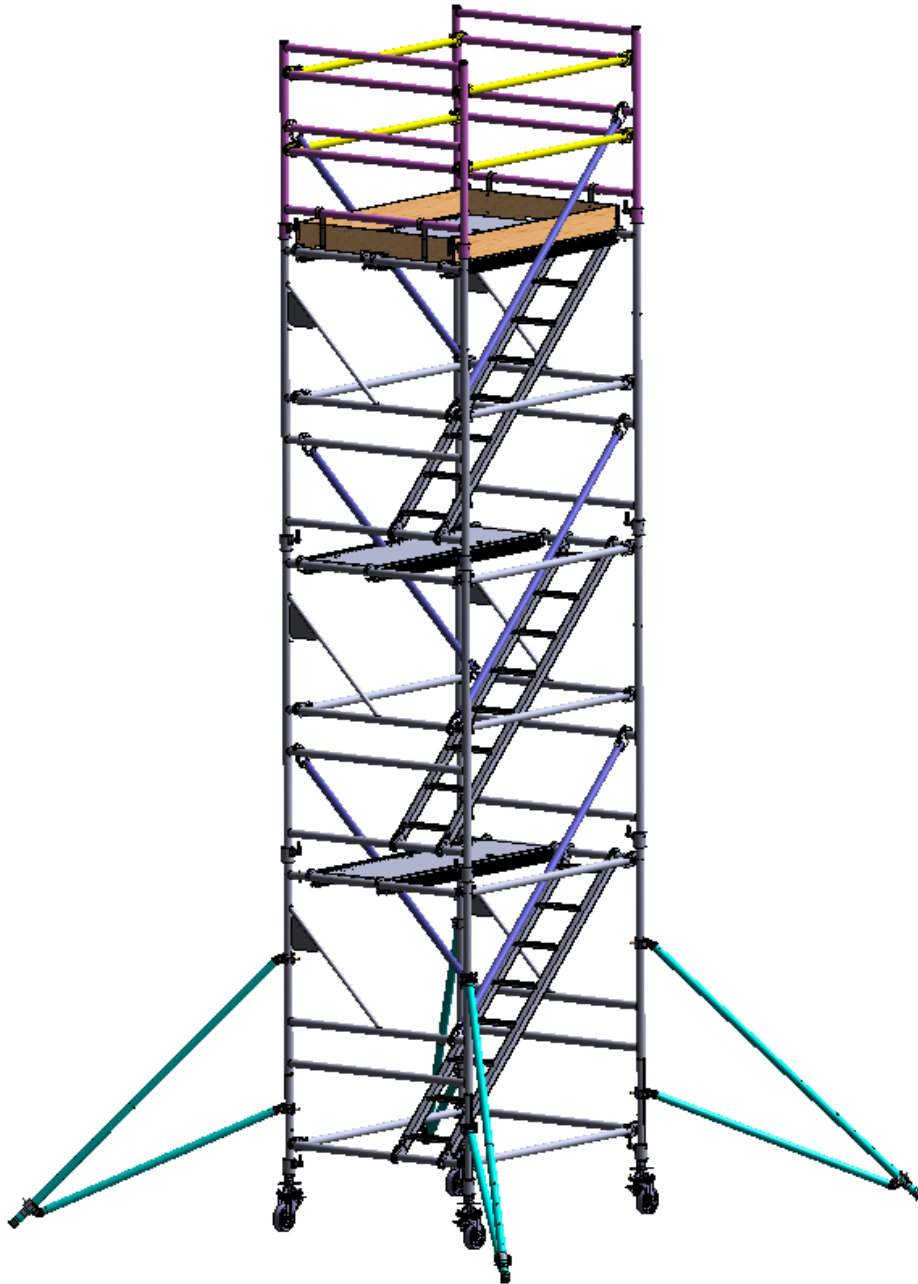
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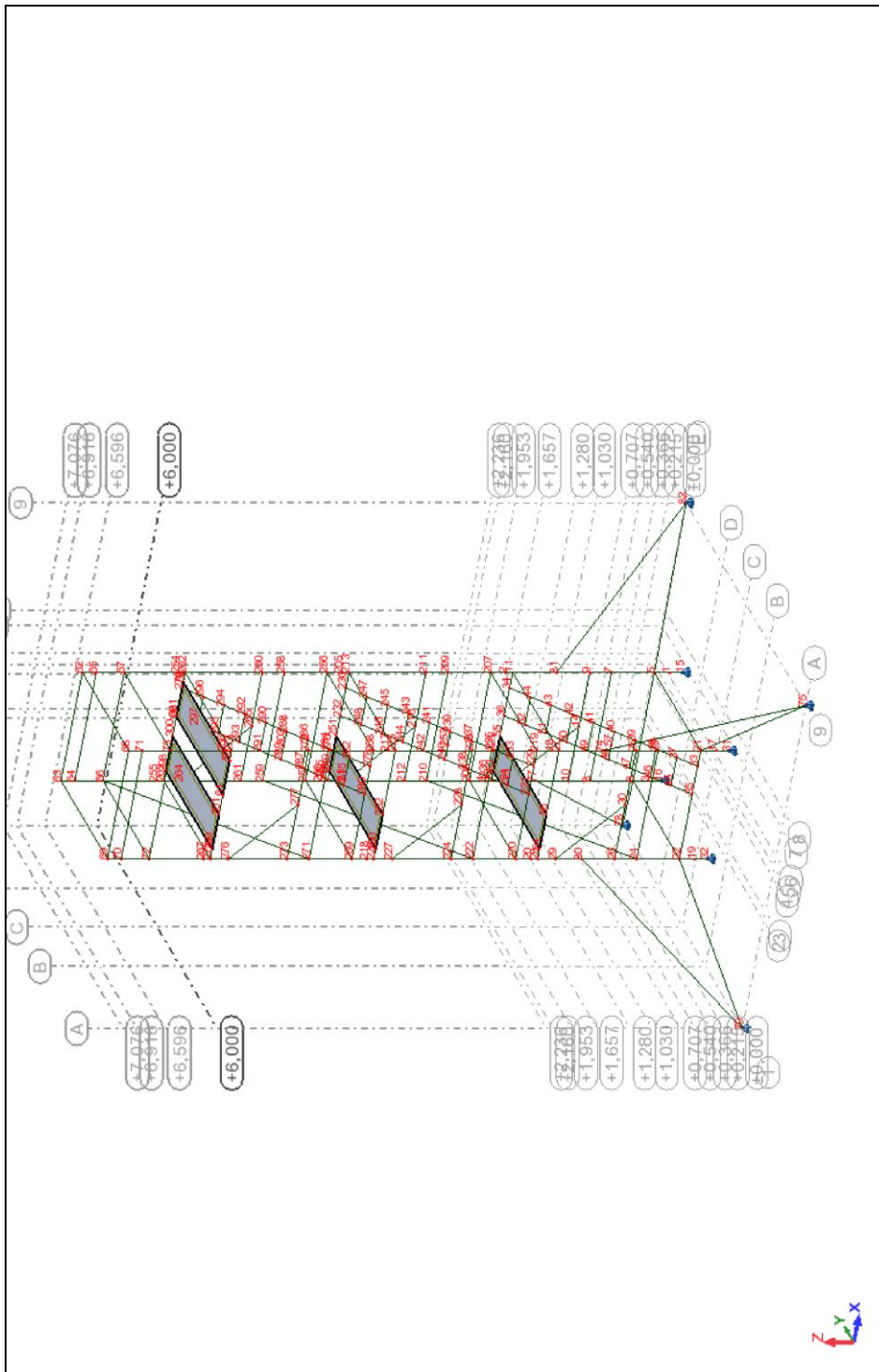
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## Vue d'ensemble



## Vue de modélisation et nœuds



## Hypothèses de calculs :

- Echafaudage Roulant de service Aluminium en éléments préfabriqués suivant norme EN 1004:2005-05
- Fabrication suivant plan d'ensemble : 10608-0E1/D
- Utilisation suivant notice d'utilisation : 10608-NT1/D
- Contrôle physique de rigidité de structure suivant l'annexe A de la norme EN 1004:2005-05 repris et détaillé dans le rapport ASD : 10608-RE1
- Hauteur maximale du plancher de service supérieur : 6m
- Utilisation intérieure ou, extérieure avec un vent maximum de 45km/h
- Utilisation au vent avec une seule personne sur le plancher supérieur.
- Chargement maxi planchers en classe3 maxi sur le plancher supérieur de 200daN/m<sup>2</sup> répartis sur la paire de planchers
- Surface d'un plancher: 0.94m<sup>2</sup>
- Poids à vide assemblé : ~400daN
- Utilisation obligatoire des jambes de forces (avec empattement au sol mini de 3.75x4.1m)
- Assemblage et exploitation de niveau (défaut de niveau tolérée : 1%) suivant les règles de l'art.
- Accès personnel uniquement par l'intérieur par les échelles à marches de classe B, prévues à cet effet. Aucun accès par l'extérieur de la tour.
- Règles de calculs : EN 1999-1-1:2007-08 et EN 1004:2005-05
- Règles de pondérations : EN 1990:2003-03 et EN 1990/A1/NA:2007-12 et EN 1004:2005-05

## note de calcul

Propriétés du projet: **10608-nc1a\_2013**

Type de structure : Portique spatial

Coordonnées du centre de gravité de la structure:

X = -0.003 (m)

Y = -0.000 (m)

Z = 3.477 (m)

Moments d'inertie centraux de la structure:

Ix = 783.482 (kg\*m2)

Iy = 750.236 (kg\*m2)

Iz = 168.090 (kg\*m2)

Masse = 157.451 (kg)

Description de la structure

|                                  |      |
|----------------------------------|------|
| Nombre de noeuds:                | 181  |
| Nombre de barres:                | 171  |
| Éléments finis linéiques:        | 270  |
| Éléments finis surfaciques:      | 0    |
| Éléments finis volumiques:       | 0    |
| Nbre de degrés de liberté stat.: | 1062 |
| Cas:                             | 24   |
| Combinaisons:                    | 3    |

### Liste de cas de charges/types de calculs

**Cas 1** : GRP1

**Type d'analyse: Statique linéaire**

**Cas 2** : GRP2

**Type d'analyse: Statique linéaire**

**Cas 3** : GRP3

**Type d'analyse: Statique linéaire**

**Cas 4** : GRP4  
**Type d'analyse: Statique linéaire**

**Cas 5** : GRP5  
**Type d'analyse: Statique linéaire**

**Cas 6** : GRP2-  
**Type d'analyse: Statique linéaire**

**Cas 7** : COMB\_chargement\_1.1  
**Type d'analyse: Combinaison linéaire**

**Cas 8** : COMB\_chargement\_1.2  
**Type d'analyse: Combinaison linéaire**

**Cas 9** : COMB\_chargement\_2  
**Type d'analyse: Combinaison linéaire**

**Cas 10** : ELU  
**Type d'analyse:**

**Cas 11** : ELU+  
**Type d'analyse:**

**Cas 12** : ELU-  
**Type d'analyse:**

**Cas 13** : ELS  
**Type d'analyse:**

**Cas 14** : ELS+  
**Type d'analyse:**

**Cas 15** : ELS-  
**Type d'analyse:**

**Cas 16** : ELS:CAR  
**Type d'analyse:**

**Cas 17** : ELS:CAR+  
**Type d'analyse:**

**Cas 18** : ELS:CAR-



**Type d'analyse:**

**Cas 19** : ELS:FRE  
**Type d'analyse:**

**Cas 20** : ELS:FRE+  
**Type d'analyse:**

**Cas 21** : ELS:FRE-  
**Type d'analyse:**

**Cas 22** : ELS:QPR  
**Type d'analyse:**

**Cas 23** : ELS:QPR+  
**Type d'analyse:**

**Cas 24** : ELS:QPR-  
**Type d'analyse:**

## Propriétés des profilés

### Caractéristiques de la section:

RONDE\_50x2



HY=50,0, HZ=50,0 [mm]  
AX=3,016 [cm<sup>2</sup>]  
IX=17,402, IY=8,701, IZ=8,701 [cm<sup>4</sup>]  
Matériau=6060-T6

RONDE\_30x2



HY=30,0, HZ=30,0 [mm]  
AX=1,759 [cm<sup>2</sup>]  
IX=3,466, IY=1,733, IZ=1,733 [cm<sup>4</sup>]  
Matériau=6060-T6

tf\_m30x5



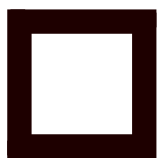
HY=25,0, HZ=25,0 [mm]  
AX=4,909 [cm<sup>2</sup>]  
IX=3,835, IY=1,917, IZ=1,917 [cm<sup>4</sup>]  
Matériau=6060-T6

RONDE\_50x3



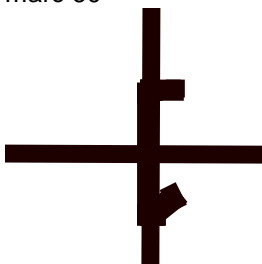
HY=50,0, HZ=50,0 [mm]  
AX=4,430 [cm<sup>2</sup>]  
IX=24,562, IY=12,281, IZ=12,281 [cm<sup>4</sup>]  
Matériau=6060-T6

RECT\_50x3



HY=50,0, HZ=50,0 [mm]  
AX=5,640 [cm<sup>2</sup>]  
IX=31,147, IY=20,849, IZ=20,849 [cm<sup>4</sup>]  
Matériau=6060-T6

marc 60



HY=19,3, HZ=85,9 [mm]  
AX=3,563 [cm<sup>2</sup>]  
IX=0,093, IY=30,542, IZ=0,909 [cm<sup>4</sup>]  
Matériau=6060-T6

## Pondérations

### Pondérations suivant le règlement : NF-EN 1990:2002/A1:2006 H<1000m

#### Paramètres de la création des pondérations

#### Type de pondérations : complètes

##### Liste de cas actifs :

|          |       |    |
|----------|-------|----|
| 1: GRP1  | STRC  | G1 |
| 3: GRP3  | vent  | W1 |
| 4: GRP4  | vent  | W1 |
| 2: GRP2  | CAT_E | Q1 |
| 5: GRP5  | STRC  | G1 |
| 6: GRP2- | CAT_E | Q1 |

##### Liste de modèles de combinaison :

|     |                        |
|-----|------------------------|
| ELU | STR                    |
| ELS | caractéristique (CAR)  |
| ELS | fréquente (FRE)        |
| ELS | quasi-permanente (QPR) |

##### Liste de groupes définis :

|                 |    |           |
|-----------------|----|-----------|
| permanente:     | G1 | ou,       |
| d'exploitation: | Q1 | ou excl., |
| vent:           | W1 | ou,       |

##### Liste de relations définies :

|                 |          |
|-----------------|----------|
| permanente:     | G1       |
| d'exploitation: | Q1 ou Q2 |
| vent:           | W1       |

## Combinaisons

| Combinaison/Comp. | Définition  |
|-------------------|---|
| ELU/ 1            | GRP1*1.35 + GRP5*1.35                                     |
| ELU/ 2            | GRP1*1.35 + GRP3*0.90 + GRP4*0.90 + GRP2*1.50 + GRP5*1.35 |
| ELU/ 3            | GRP1*1.35 + GRP2*1.50 + GRP5*1.35                         |
| ELU/ 4            | GRP1*1.35 + GRP3*0.90 + GRP2*1.50 + GRP5*1.35             |
| ELU/ 5            | GRP1*1.35 + GRP4*0.90 + GRP2*1.50 + GRP5*1.35             |
| ELU/ 6            | GRP1*1.35 + GRP3*0.90 + GRP4*0.90 + GRP5*1.35 + GRP2*1.50 |
| ELU/ 7            | GRP1*1.35 + GRP5*1.35 + GRP2*1.50                         |
| ELU/ 8            | GRP1*1.35 + GRP3*0.90 + GRP5*1.35 + GRP2*1.50             |
| ELU/ 9            | GRP1*1.35 + GRP4*0.90 + GRP5*1.35 + GRP2*1.50             |
| ELU/ 10           | GRP1*1.00 + GRP5*1.00                                     |
| ELU/ 11           | GRP1*1.00 + GRP3*0.90 + GRP4*0.90 + GRP2*1.50 + GRP5*1.00 |
| ELU/ 12           | GRP1*1.00 + GRP2*1.50 + GRP5*1.00                         |
| ELU/ 13           | GRP1*1.00 + GRP3*0.90 + GRP2*1.50 + GRP5*1.00             |
| ELU/ 14           | GRP1*1.00 + GRP4*0.90 + GRP2*1.50 + GRP5*1.00             |
| ELU/ 15           | GRP1*1.00 + GRP3*0.90 + GRP4*0.90 + GRP5*1.00 + GRP2*1.50 |
| ELU/ 16           | GRP1*1.00 + GRP5*1.00 + GRP2*1.50                         |
| ELU/ 17           | GRP1*1.00 + GRP3*0.90 + GRP5*1.00 + GRP2*1.50             |
| ELU/ 18           | GRP1*1.00 + GRP4*0.90 + GRP5*1.00 + GRP2*1.50             |
| ELU/ 19           | GRP1*1.35 + GRP5*1.00                                     |
| ELU/ 20           | GRP1*1.35 + GRP3*0.90 + GRP4*0.90 + GRP2*1.50 + GRP5*1.00 |
| ELU/ 21           | GRP1*1.35 + GRP2*1.50 + GRP5*1.00                         |
| ELU/ 22           | GRP1*1.35 + GRP3*0.90 + GRP2*1.50 + GRP5*1.00             |
| ELU/ 23           | GRP1*1.35 + GRP4*0.90 + GRP2*1.50 + GRP5*1.00             |
| ELU/ 24           | GRP1*1.35 + GRP3*0.90 + GRP4*0.90 + GRP5*1.00 + GRP2*1.50 |
| ELU/ 25           | GRP1*1.35 + GRP5*1.00 + GRP2*1.50                         |
| ELU/ 26           | GRP1*1.35 + GRP3*0.90 + GRP5*1.00 + GRP2*1.50             |
| ELU/ 27           | GRP1*1.35 + GRP4*0.90 + GRP5*1.00 + GRP2*1.50             |
| ELU/ 28           | GRP1*1.00 + GRP5*1.35                                     |
| ELU/ 29           | GRP1*1.00 + GRP3*0.90 + GRP4*0.90 + GRP2*1.50 + GRP5*1.35 |
| ELU/ 30           | GRP1*1.00 + GRP2*1.50 + GRP5*1.35                         |
| ELU/ 31           | GRP1*1.00 + GRP3*0.90 + GRP2*1.50 + GRP5*1.35             |
| ELU/ 32           | GRP1*1.00 + GRP4*0.90 + GRP2*1.50 + GRP5*1.35             |
| ELU/ 33           | GRP1*1.00 + GRP3*0.90 + GRP4*0.90 + GRP5*1.35 + GRP2*1.50 |
| ELU/ 34           | GRP1*1.00 + GRP5*1.35 + GRP2*1.50                         |
| ELU/ 35           | GRP1*1.00 + GRP3*0.90 + GRP5*1.35 + GRP2*1.50             |
| ELU/ 36           | GRP1*1.00 + GRP4*0.90 + GRP5*1.35 + GRP2*1.50             |
| ELU/ 37           | GRP1*1.35 + GRP3*1.50 + GRP4*1.50 + GRP5*1.35             |
| ELU/ 38           | GRP1*1.35 + GRP3*1.50 + GRP5*1.35                         |
| ELU/ 39           | GRP1*1.35 + GRP4*1.50 + GRP5*1.35                         |
| ELU/ 40           | GRP1*1.35 + GRP3*1.50 + GRP4*1.50 + GRP2*1.50 + GRP5*1.35 |
| ELU/ 41           | GRP1*1.35 + GRP3*1.50 + GRP2*1.50 + GRP5*1.35             |
| ELU/ 42           | GRP1*1.35 + GRP4*1.50 + GRP2*1.50 + GRP5*1.35             |
| ELU/ 43           | GRP1*1.35 + GRP3*1.50 + GRP4*1.50 + GRP5*1.35 + GRP2*1.50 |
| ELU/ 44           | GRP1*1.35 + GRP3*1.50 + GRP5*1.35 + GRP2*1.50             |
| ELU/ 45           | GRP1*1.35 + GRP4*1.50 + GRP5*1.35 + GRP2*1.50             |
| ELU/ 46           | GRP1*1.00 + GRP3*1.50 + GRP4*1.50 + GRP5*1.00             |
| ELU/ 47           | GRP1*1.00 + GRP3*1.50 + GRP5*1.00                         |

| Combinaison/Comp. | Définition  |
|-------------------|---|
| ELU/ 48           | GRP1*1.00 + GRP4*1.50 + GRP5*1.00                         |
| ELU/ 49           | GRP1*1.00 + GRP3*1.50 + GRP4*1.50 + GRP2*1.50 + GRP5*1.00 |
| ELU/ 50           | GRP1*1.00 + GRP3*1.50 + GRP2*1.50 + GRP5*1.00             |
| ELU/ 51           | GRP1*1.00 + GRP4*1.50 + GRP2*1.50 + GRP5*1.00             |
| ELU/ 52           | GRP1*1.00 + GRP3*1.50 + GRP4*1.50 + GRP5*1.00 + GRP2*1.50 |
| ELU/ 53           | GRP1*1.00 + GRP3*1.50 + GRP5*1.00 + GRP2*1.50             |
| ELU/ 54           | GRP1*1.00 + GRP4*1.50 + GRP5*1.00 + GRP2*1.50             |
| ELU/ 55           | GRP1*1.35 + GRP3*1.50 + GRP4*1.50 + GRP5*1.00             |
| ELU/ 56           | GRP1*1.35 + GRP3*1.50 + GRP5*1.00                         |
| ELU/ 57           | GRP1*1.35 + GRP4*1.50 + GRP5*1.00                         |
| ELU/ 58           | GRP1*1.35 + GRP3*1.50 + GRP4*1.50 + GRP2*1.50 + GRP5*1.00 |
| ELU/ 59           | GRP1*1.35 + GRP3*1.50 + GRP2*1.50 + GRP5*1.00             |
| ELU/ 60           | GRP1*1.35 + GRP4*1.50 + GRP2*1.50 + GRP5*1.00             |
| ELU/ 61           | GRP1*1.35 + GRP3*1.50 + GRP4*1.50 + GRP5*1.00 + GRP2*1.50 |
| ELU/ 62           | GRP1*1.35 + GRP3*1.50 + GRP5*1.00 + GRP2*1.50             |
| ELU/ 63           | GRP1*1.35 + GRP4*1.50 + GRP5*1.00 + GRP2*1.50             |
| ELU/ 64           | GRP1*1.00 + GRP3*1.50 + GRP4*1.50 + GRP5*1.35             |
| ELU/ 65           | GRP1*1.00 + GRP3*1.50 + GRP5*1.35                         |
| ELU/ 66           | GRP1*1.00 + GRP4*1.50 + GRP5*1.35                         |
| ELU/ 67           | GRP1*1.00 + GRP3*1.50 + GRP4*1.50 + GRP2*1.50 + GRP5*1.35 |
| ELU/ 68           | GRP1*1.00 + GRP3*1.50 + GRP2*1.50 + GRP5*1.35             |
| ELU/ 69           | GRP1*1.00 + GRP4*1.50 + GRP2*1.50 + GRP5*1.35             |
| ELU/ 70           | GRP1*1.00 + GRP3*1.50 + GRP4*1.50 + GRP5*1.35 + GRP2*1.50 |
| ELU/ 71           | GRP1*1.00 + GRP3*1.50 + GRP5*1.35 + GRP2*1.50             |
| ELU/ 72           | GRP1*1.00 + GRP4*1.50 + GRP5*1.35 + GRP2*1.50             |
| ELS:CAR/ 1        | GRP1*1.00 + GRP5*1.00                                     |
| ELS:CAR/ 2        | GRP1*1.00 + GRP3*0.60 + GRP4*0.60 + GRP2*1.00 + GRP5*1.00 |
| ELS:CAR/ 3        | GRP1*1.00 + GRP2*1.00 + GRP5*1.00                         |
| ELS:CAR/ 4        | GRP1*1.00 + GRP3*0.60 + GRP2*1.00 + GRP5*1.00             |
| ELS:CAR/ 5        | GRP1*1.00 + GRP4*0.60 + GRP2*1.00 + GRP5*1.00             |
| ELS:CAR/ 6        | GRP1*1.00 + GRP3*0.60 + GRP4*0.60 + GRP5*1.00 + GRP2*1.00 |
| ELS:CAR/ 7        | GRP1*1.00 + GRP5*1.00 + GRP2*1.00                         |
| ELS:CAR/ 8        | GRP1*1.00 + GRP3*0.60 + GRP5*1.00 + GRP2*1.00             |
| ELS:CAR/ 9        | GRP1*1.00 + GRP4*0.60 + GRP5*1.00 + GRP2*1.00             |
| ELS:CAR/ 10       | GRP1*1.00 + GRP3*1.00 + GRP4*1.00 + GRP5*1.00             |
| ELS:CAR/ 11       | GRP1*1.00 + GRP3*1.00 + GRP5*1.00                         |
| ELS:CAR/ 12       | GRP1*1.00 + GRP4*1.00 + GRP5*1.00                         |
| ELS:CAR/ 13       | GRP1*1.00 + GRP3*1.00 + GRP4*1.00 + GRP2*1.00 + GRP5*1.00 |
| ELS:CAR/ 14       | GRP1*1.00 + GRP3*1.00 + GRP2*1.00 + GRP5*1.00             |
| ELS:CAR/ 15       | GRP1*1.00 + GRP4*1.00 + GRP2*1.00 + GRP5*1.00             |
| ELS:CAR/ 16       | GRP1*1.00 + GRP3*1.00 + GRP4*1.00 + GRP5*1.00 + GRP2*1.00 |
| ELS:CAR/ 17       | GRP1*1.00 + GRP3*1.00 + GRP5*1.00 + GRP2*1.00             |
| ELS:CAR/ 18       | GRP1*1.00 + GRP4*1.00 + GRP5*1.00 + GRP2*1.00             |
| ELS:FRE/ 19       | GRP1*1.00 + GRP5*1.00                                     |
| ELS:FRE/ 20       | GRP1*1.00 + GRP2*0.90 + GRP5*1.00                         |
| ELS:FRE/ 21       | GRP1*1.00 + GRP5*1.00 + GRP2*0.90                         |
| ELS:FRE/ 22       | GRP1*1.00 + GRP3*0.20 + GRP4*0.20 + GRP5*1.00             |
| ELS:FRE/ 23       | GRP1*1.00 + GRP3*0.20 + GRP5*1.00                         |
| ELS:FRE/ 24       | GRP1*1.00 + GRP4*0.20 + GRP5*1.00                         |
| ELS:FRE/ 25       | GRP1*1.00 + GRP3*0.20 + GRP4*0.20 + GRP2*0.80 + GRP5*1.00 |

| Combinaison/Comp. | Définition  |
|-------------------|---|
| ELS:FRE/ 26       | GRP1*1.00 + GRP3*0.20 + GRP2*0.80 + GRP5*1.00             |
| ELS:FRE/ 27       | GRP1*1.00 + GRP4*0.20 + GRP2*0.80 + GRP5*1.00             |
| ELS:FRE/ 28       | GRP1*1.00 + GRP3*0.20 + GRP4*0.20 + GRP5*1.00 + GRP2*0.80 |
| ELS:FRE/ 29       | GRP1*1.00 + GRP3*0.20 + GRP5*1.00 + GRP2*0.80             |
| ELS:FRE/ 30       | GRP1*1.00 + GRP4*0.20 + GRP5*1.00 + GRP2*0.80             |
| ELS:QPR/ 31       | GRP1*1.00 + GRP5*1.00                                     |
| ELS:QPR/ 32       | GRP1*1.00 + GRP2*0.80 + GRP5*1.00                         |
| ELS:QPR/ 33       | GRP1*1.00 + GRP5*1.00 + GRP2*0.80                         |
| ELS:CAR/ 1        | GRP1*1.00 + GRP5*1.00                                     |
| ELS:CAR/ 2        | GRP1*1.00 + GRP3*0.60 + GRP4*0.60 + GRP2*1.00 + GRP5*1.00 |
| ELS:CAR/ 3        | GRP1*1.00 + GRP2*1.00 + GRP5*1.00                         |
| ELS:CAR/ 4        | GRP1*1.00 + GRP3*0.60 + GRP2*1.00 + GRP5*1.00             |
| ELS:CAR/ 5        | GRP1*1.00 + GRP4*0.60 + GRP2*1.00 + GRP5*1.00             |
| ELS:CAR/ 6        | GRP1*1.00 + GRP3*0.60 + GRP4*0.60 + GRP5*1.00 + GRP2*1.00 |
| ELS:CAR/ 7        | GRP1*1.00 + GRP5*1.00 + GRP2*1.00                         |
| ELS:CAR/ 8        | GRP1*1.00 + GRP3*0.60 + GRP5*1.00 + GRP2*1.00             |
| ELS:CAR/ 9        | GRP1*1.00 + GRP4*0.60 + GRP5*1.00 + GRP2*1.00             |
| ELS:CAR/ 10       | GRP1*1.00 + GRP3*1.00 + GRP4*1.00 + GRP5*1.00             |
| ELS:CAR/ 11       | GRP1*1.00 + GRP3*1.00 + GRP5*1.00                         |
| ELS:CAR/ 12       | GRP1*1.00 + GRP4*1.00 + GRP5*1.00                         |
| ELS:CAR/ 13       | GRP1*1.00 + GRP3*1.00 + GRP4*1.00 + GRP2*1.00 + GRP5*1.00 |
| ELS:CAR/ 14       | GRP1*1.00 + GRP3*1.00 + GRP2*1.00 + GRP5*1.00             |
| ELS:CAR/ 15       | GRP1*1.00 + GRP4*1.00 + GRP2*1.00 + GRP5*1.00             |
| ELS:CAR/ 16       | GRP1*1.00 + GRP3*1.00 + GRP4*1.00 + GRP5*1.00 + GRP2*1.00 |
| ELS:CAR/ 17       | GRP1*1.00 + GRP3*1.00 + GRP5*1.00 + GRP2*1.00             |
| ELS:CAR/ 18       | GRP1*1.00 + GRP4*1.00 + GRP5*1.00 + GRP2*1.00             |
| ELS:FRE/ 1        | GRP1*1.00 + GRP5*1.00                                     |
| ELS:FRE/ 2        | GRP1*1.00 + GRP2*0.90 + GRP5*1.00                         |
| ELS:FRE/ 3        | GRP1*1.00 + GRP5*1.00 + GRP2*0.90                         |
| ELS:FRE/ 4        | GRP1*1.00 + GRP3*0.20 + GRP4*0.20 + GRP5*1.00             |
| ELS:FRE/ 5        | GRP1*1.00 + GRP3*0.20 + GRP5*1.00                         |
| ELS:FRE/ 6        | GRP1*1.00 + GRP4*0.20 + GRP5*1.00                         |
| ELS:FRE/ 7        | GRP1*1.00 + GRP3*0.20 + GRP4*0.20 + GRP2*0.80 + GRP5*1.00 |
| ELS:FRE/ 8        | GRP1*1.00 + GRP3*0.20 + GRP2*0.80 + GRP5*1.00             |
| ELS:FRE/ 9        | GRP1*1.00 + GRP4*0.20 + GRP2*0.80 + GRP5*1.00             |
| ELS:FRE/ 10       | GRP1*1.00 + GRP3*0.20 + GRP4*0.20 + GRP5*1.00 + GRP2*0.80 |
| ELS:FRE/ 11       | GRP1*1.00 + GRP3*0.20 + GRP5*1.00 + GRP2*0.80             |
| ELS:FRE/ 12       | GRP1*1.00 + GRP4*0.20 + GRP5*1.00 + GRP2*0.80             |
| ELS:QPR/ 1        | GRP1*1.00 + GRP5*1.00                                     |
| ELS:QPR/ 2        | GRP1*1.00 + GRP2*0.80 + GRP5*1.00                         |
| ELS:QPR/ 3        | GRP1*1.00 + GRP5*1.00 + GRP2*0.80                         |

## Combinaisons de stabilité de position §11.4

| Combinaison | Nom                 | Type d'analyse       | Type la combinaison | Définition                         |
|-------------|---------------------|----------------------|---------------------|------------------------------------|
| 7 (C)       | COMB_chargement_1.1 | Combinaison linéaire | ELS                 | (GRP1+GRP2-)*1.00+(GRP3+GRP5)*1.50 |
| 8 (C)       | COMB_chargement_1.2 | Combinaison linéaire | ELS                 | (GRP1+GRP2-)*1.00+(GRP4+GRP5)*1.50 |
| 9 (C)       | COMB_chargement_2   | Combinaison linéaire | ELS                 | GRP1*1.00+(GRP4+GRP5)*1.30         |

## Caractéristiques - Barres

| Nom de la section | Liste des barres   | AX [cm2] | AY [cm2] | AZ [cm2] | IX [cm4] | IY [cm4] | IZ [cm4] |
|-------------------|--|----------|----------|----------|----------|----------|----------|
| RONDE_50x2        | 1A6 10A15 36A107 11-6A123 127A130 134A1-37 157A160 164A167 | 3,016    | 1,508    | 1,508    | 17,402   | 8,701    | 8,701    |
| RONDE_30x2        | 7 16 131 138 161 168                                       | 1,759    | 0,880    | 0,880    | 3,466    | 1,733    | 1,733    |
| tf_m30x5          | 8 9 17 18  | 4,909    | 4,142    | 4,142    | 3,835    | 1,917    | 1,917    |
| RONDE_50x3        | 19A21 108A115 139A1-41 169A171                             | 4,430    | 2,215    | 2,215    | 24,562   | 12,281   | 12,281   |
| RECT_50x3         | 22 23 32 33 142 143 152 153 172 173 182 183                | 5,640    | 3,000    | 3,000    | 31,147   | 20,849   | 20,849   |
| marc 60           | 24A31 144A151 174A1-81                                     | 3,563    | 1,196    | 2,401    | 0,093    | 30,542   | 0,909    |

## Caractéristiques - Matériaux

|   | Matériau | E [daN/mm2] | G [daN/mm2] | NU   | LX [1/C] | RO [daN/m3] | Re [daN/mm2] |
|---|----------|-------------|-------------|------|----------|-------------|--------------|
| 1 | 6060-T6  | 7950,00     | 2780,00     | 0,34 | 0,00     | 2700,00     | 21,50        |



## Nœuds

| Noeud | X [m]  | Y [m]  | Z [m] | Code de l'appui | Appui  |
|-------|--------|--------|-------|-----------------|--------|
| 1     | 0,670  | 0,840  | 0,366 |                 |        |
| 2     | 0,670  | 0,840  | 2,236 |                 |        |
| 3     | -0,670 | 0,840  | 0,366 |                 |        |
| 4     | -0,670 | 0,840  | 2,236 |                 |        |
| 5     | 0,670  | 0,840  | 0,540 |                 |        |
| 6     | -0,670 | 0,840  | 0,540 |                 |        |
| 7     | 0,670  | 0,840  | 1,030 |                 |        |
| 8     | -0,670 | 0,840  | 1,030 |                 |        |
| 9     | 0,670  | 0,840  | 1,280 |                 |        |
| 10    | -0,670 | 0,840  | 1,280 |                 |        |
| 11    | 0,670  | 0,840  | 2,160 |                 |        |
| 12    | -0,670 | 0,840  | 2,160 |                 |        |
| 13    | -0,670 | 0,840  | 1,953 |                 |        |
| 14    | 0,0    | 0,840  | 1,280 |                 |        |
| 15    | 0,670  | 0,840  | 0,215 | bbblll          | Rotule |
| 16    | -0,670 | 0,840  | 0,215 | bbblll          | Rotule |
| 17    | 0,670  | -0,840 | 0,366 |                 |        |
| 18    | 0,670  | -0,840 | 2,236 |                 |        |
| 19    | -0,670 | -0,840 | 0,366 |                 |        |
| 20    | -0,670 | -0,840 | 2,236 |                 |        |
| 21    | 0,670  | -0,840 | 0,540 |                 |        |
| 22    | -0,670 | -0,840 | 0,540 |                 |        |
| 23    | 0,670  | -0,840 | 1,030 |                 |        |
| 24    | -0,670 | -0,840 | 1,030 |                 |        |
| 25    | 0,670  | -0,840 | 1,280 |                 |        |
| 26    | -0,670 | -0,840 | 1,280 |                 |        |
| 27    | 0,670  | -0,840 | 2,160 |                 |        |
| 28    | -0,670 | -0,840 | 2,160 |                 |        |
| 29    | -0,670 | -0,840 | 1,953 |                 |        |
| 30    | 0,0    | -0,840 | 1,280 |                 |        |
| 31    | 0,670  | -0,840 | 0,215 | bbblll          | Rotule |
| 32    | -0,670 | -0,840 | 0,215 | bbblll          | Rotule |
| 33    | 0,477  | -0,840 | 0,540 |                 |        |
| 34    | 0,477  | 0,840  | 2,160 |                 |        |
| 35    | 0,132  | -0,840 | 0,540 |                 |        |
| 36    | 0,132  | 0,840  | 2,160 |                 |        |
| 37    | 0,477  | -0,653 | 0,720 |                 |        |
| 38    | 0,477  | -0,467 | 0,900 |                 |        |
| 39    | 0,477  | -0,280 | 1,080 |                 |        |
| 40    | 0,477  | -0,093 | 1,260 |                 |        |
| 41    | 0,477  | 0,093  | 1,440 |                 |        |
| 42    | 0,477  | 0,280  | 1,620 |                 |        |
| 43    | 0,477  | 0,467  | 1,800 |                 |        |
| 44    | 0,477  | 0,653  | 1,980 |                 |        |
| 45    | 0,132  | -0,653 | 0,720 |                 |        |
| 46    | 0,132  | -0,467 | 0,900 |                 |        |

| Noeud | X [m]  | Y [m]  | Z [m] | Code de l'appui | Appui  |
|-------|--------|--------|-------|-----------------|--------|
| 47    | 0,132  | -0,280 | 1,080 |                 |        |
| 48    | 0,132  | -0,093 | 1,260 |                 |        |
| 49    | 0,132  | 0,093  | 1,440 |                 |        |
| 50    | 0,132  | 0,280  | 1,620 |                 |        |
| 51    | 0,132  | 0,467  | 1,800 |                 |        |
| 52    | 0,132  | 0,653  | 1,980 |                 |        |
| 53    | -0,550 | 0,840  | 2,160 |                 |        |
| 54    | -0,550 | -0,840 | 2,160 |                 |        |
| 55    | -0,120 | 0,840  | 2,160 |                 |        |
| 56    | -0,120 | -0,840 | 2,160 |                 |        |
| 57    | 0,304  | -0,093 | 1,260 |                 |        |
| 58    | 0,550  | 0,840  | 5,900 |                 |        |
| 59    | 0,550  | -0,840 | 5,900 |                 |        |
| 60    | 0,120  | 0,840  | 5,900 |                 |        |
| 61    | 0,120  | -0,840 | 5,900 |                 |        |
| 62    | 0,670  | 0,840  | 7,076 |                 |        |
| 63    | -0,670 | 0,840  | 7,076 |                 |        |
| 64    | -0,670 | 0,840  | 6,916 |                 |        |
| 65    | 0,670  | 0,840  | 6,916 |                 |        |
| 66    | -0,670 | 0,840  | 6,596 |                 |        |
| 67    | 0,670  | 0,840  | 6,596 |                 |        |
| 68    | 0,670  | -0,840 | 7,076 |                 |        |
| 69    | -0,670 | -0,840 | 7,076 |                 |        |
| 70    | -0,670 | -0,840 | 6,916 |                 |        |
| 71    | 0,670  | -0,840 | 6,916 |                 |        |
| 72    | -0,670 | -0,840 | 6,596 |                 |        |
| 73    | 0,670  | -0,840 | 6,596 |                 |        |
| 74    | 0,670  | -0,840 | 1,657 |                 |        |
| 75    | 2,000  | -2,175 | 0,0   | bbblll          | Rotule |
| 77    | -0,670 | 0,840  | 1,657 |                 |        |
| 78    | -2,000 | 2,175  | 0,0   | bbblll          | Rotule |
| 79    | -2,000 | -2,175 | 0,0   | bbblll          | Rotule |
| 80    | -0,670 | -0,840 | 1,657 |                 |        |
| 81    | 0,670  | 0,840  | 1,657 |                 |        |
| 82    | 2,000  | 2,175  | 0,0   | bbblll          | Rotule |
| 205   | 0,670  | 0,840  | 4,106 |                 |        |
| 206   | -0,670 | 0,840  | 4,106 |                 |        |
| 207   | 0,670  | 0,840  | 2,410 |                 |        |
| 208   | -0,670 | 0,840  | 2,410 |                 |        |
| 209   | 0,670  | 0,840  | 2,900 |                 |        |
| 210   | -0,670 | 0,840  | 2,900 |                 |        |
| 211   | 0,670  | 0,840  | 3,150 |                 |        |
| 212   | -0,670 | 0,840  | 3,150 |                 |        |
| 213   | 0,670  | 0,840  | 4,030 |                 |        |
| 214   | -0,670 | 0,840  | 4,030 |                 |        |
| 215   | -0,670 | 0,840  | 3,823 |                 |        |
| 216   | 0,0    | 0,840  | 3,150 |                 |        |
| 217   | 0,670  | -0,840 | 4,106 |                 |        |
| 218   | -0,670 | -0,840 | 4,106 |                 |        |

| Noeud | X [m]  | Y [m]  | Z [m] | Code de l'appui | Appui |
|-------|--------|--------|-------|-----------------|-------|
| 219   | 0,670  | -0,840 | 2,410 |                 |       |
| 220   | -0,670 | -0,840 | 2,410 |                 |       |
| 221   | 0,670  | -0,840 | 2,900 |                 |       |
| 222   | -0,670 | -0,840 | 2,900 |                 |       |
| 223   | 0,670  | -0,840 | 3,150 |                 |       |
| 224   | -0,670 | -0,840 | 3,150 |                 |       |
| 225   | 0,670  | -0,840 | 4,030 |                 |       |
| 226   | -0,670 | -0,840 | 4,030 |                 |       |
| 227   | -0,670 | -0,840 | 3,823 |                 |       |
| 228   | 0,0    | -0,840 | 3,150 |                 |       |
| 229   | 0,477  | -0,840 | 2,410 |                 |       |
| 230   | 0,477  | 0,840  | 4,030 |                 |       |
| 231   | 0,132  | -0,840 | 2,410 |                 |       |
| 232   | 0,132  | 0,840  | 4,030 |                 |       |
| 233   | 0,477  | -0,653 | 2,590 |                 |       |
| 234   | 0,132  | -0,653 | 2,590 |                 |       |
| 235   | 0,477  | -0,467 | 2,770 |                 |       |
| 236   | 0,132  | -0,467 | 2,770 |                 |       |
| 237   | 0,477  | -0,280 | 2,950 |                 |       |
| 238   | 0,132  | -0,280 | 2,950 |                 |       |
| 239   | 0,477  | -0,093 | 3,130 |                 |       |
| 240   | 0,132  | -0,093 | 3,130 |                 |       |
| 241   | 0,477  | 0,093  | 3,310 |                 |       |
| 242   | 0,132  | 0,093  | 3,310 |                 |       |
| 243   | 0,477  | 0,280  | 3,490 |                 |       |
| 244   | 0,132  | 0,280  | 3,490 |                 |       |
| 245   | 0,477  | 0,467  | 3,670 |                 |       |
| 246   | 0,132  | 0,467  | 3,670 |                 |       |
| 247   | 0,477  | 0,653  | 3,850 |                 |       |
| 248   | 0,132  | 0,653  | 3,850 |                 |       |
| 249   | -0,550 | 0,840  | 4,030 |                 |       |
| 250   | -0,550 | -0,840 | 4,030 |                 |       |
| 251   | -0,120 | 0,840  | 4,030 |                 |       |
| 252   | -0,120 | -0,840 | 4,030 |                 |       |
| 253   | 0,304  | -0,093 | 3,130 |                 |       |
| 254   | 0,670  | 0,840  | 5,976 |                 |       |
| 255   | -0,670 | 0,840  | 5,976 |                 |       |
| 256   | 0,670  | 0,840  | 4,280 |                 |       |
| 257   | -0,670 | 0,840  | 4,280 |                 |       |
| 258   | 0,670  | 0,840  | 4,770 |                 |       |
| 259   | -0,670 | 0,840  | 4,770 |                 |       |
| 260   | 0,670  | 0,840  | 5,020 |                 |       |
| 261   | -0,670 | 0,840  | 5,020 |                 |       |
| 262   | 0,670  | 0,840  | 5,900 |                 |       |
| 263   | -0,670 | 0,840  | 5,900 |                 |       |
| 264   | -0,670 | 0,840  | 5,693 |                 |       |
| 265   | 0,0    | 0,840  | 5,020 |                 |       |
| 266   | 0,670  | -0,840 | 5,976 |                 |       |
| 267   | -0,670 | -0,840 | 5,976 |                 |       |

| Noeud | X [m]  | Y [m]  | Z [m] | Code de l'appui | Appui |
|-------|--------|--------|-------|-----------------|-------|
| 268   | 0,670  | -0,840 | 4,280 |                 |       |
| 269   | -0,670 | -0,840 | 4,280 |                 |       |
| 270   | 0,670  | -0,840 | 4,770 |                 |       |
| 271   | -0,670 | -0,840 | 4,770 |                 |       |
| 272   | 0,670  | -0,840 | 5,020 |                 |       |
| 273   | -0,670 | -0,840 | 5,020 |                 |       |
| 274   | 0,670  | -0,840 | 5,900 |                 |       |
| 275   | -0,670 | -0,840 | 5,900 |                 |       |
| 276   | -0,670 | -0,840 | 5,693 |                 |       |
| 277   | 0,0    | -0,840 | 5,020 |                 |       |
| 278   | 0,477  | -0,840 | 4,280 |                 |       |
| 279   | 0,477  | 0,840  | 5,900 |                 |       |
| 280   | 0,132  | -0,840 | 4,280 |                 |       |
| 281   | 0,132  | 0,840  | 5,900 |                 |       |
| 282   | 0,477  | -0,653 | 4,460 |                 |       |
| 283   | 0,132  | -0,653 | 4,460 |                 |       |
| 284   | 0,477  | -0,467 | 4,640 |                 |       |
| 285   | 0,132  | -0,467 | 4,640 |                 |       |
| 286   | 0,477  | -0,280 | 4,820 |                 |       |
| 287   | 0,132  | -0,280 | 4,820 |                 |       |
| 288   | 0,477  | -0,093 | 5,000 |                 |       |
| 289   | 0,132  | -0,093 | 5,000 |                 |       |
| 290   | 0,477  | 0,093  | 5,180 |                 |       |
| 291   | 0,132  | 0,093  | 5,180 |                 |       |
| 292   | 0,477  | 0,280  | 5,360 |                 |       |
| 293   | 0,132  | 0,280  | 5,360 |                 |       |
| 294   | 0,477  | 0,467  | 5,540 |                 |       |
| 295   | 0,132  | 0,467  | 5,540 |                 |       |
| 296   | 0,477  | 0,653  | 5,720 |                 |       |
| 297   | 0,132  | 0,653  | 5,720 |                 |       |
| 298   | -0,550 | 0,840  | 5,900 |                 |       |
| 299   | -0,550 | -0,840 | 5,900 |                 |       |
| 300   | -0,120 | 0,840  | 5,900 |                 |       |
| 301   | -0,120 | -0,840 | 5,900 |                 |       |
| 302   | 0,304  | -0,093 | 5,000 |                 |       |

## barres

| Barre | Noeud 1 | Noeud 2 | Section    | Matériau | Longueur [m] | Gamma [Deg] | Type de barre   | Élément de construction |
|-------|---------|---------|------------|----------|--------------|-------------|-----------------|-------------------------|
| 1     | 19      | 22      | RONDE_50x2 | 6060-T6  | 0,174        | -0,0        | tubes_lg_reelle | Barre                   |
| 2     | 254     | 62      | RONDE_50x2 | 6060-T6  | 1,100        | 0,0         | tubes_lg_reelle | Barre                   |
| 3     | 5       | 6       | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 4     | 7       | 8       | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 5     | 9       | 10      | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 6     | 11      | 12      | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 7     | 13      | 14      | RONDE_30x2 | 6060-T6  | 0,950        | 0,0         | tubes_lg_reelle | Barre                   |
| 8     | 1       | 15      | tf_m30x5   | 6060-T6  | 0,151        | 0,0         | tubes_lg_reelle | Barre                   |
| 9     | 3       | 16      | tf_m30x5   | 6060-T6  | 0,151        | 0,0         | tubes_lg_reelle | Barre                   |
| 10    | 3       | 6       | RONDE_50x2 | 6060-T6  | 0,174        | 0,0         | tubes_lg_reelle | Barre                   |
| 11    | 17      | 21      | RONDE_50x2 | 6060-T6  | 0,174        | -0,0        | tubes_lg_reelle | Barre                   |
| 12    | 21      | 22      | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 13    | 23      | 24      | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 14    | 25      | 26      | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 15    | 27      | 28      | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 16    | 29      | 30      | RONDE_30x2 | 6060-T6  | 0,950        | -0,0        | tubes_lg_reelle | Barre                   |
| 17    | 17      | 31      | tf_m30x5   | 6060-T6  | 0,151        | -0,0        | tubes_lg_reelle | Barre                   |
| 18    | 19      | 32      | tf_m30x5   | 6060-T6  | 0,151        | -0,0        | tubes_lg_reelle | Barre                   |
| 19    | 21      | 5       | RONDE_50x3 | 6060-T6  | 1,680        | 0,0         | tubes_lg_reelle | Barre                   |
| 20    | 22      | 6       | RONDE_50x3 | 6060-T6  | 1,680        | 0,0         | tubes_lg_reelle | Barre                   |
| 21    | 27      | 11      | RONDE_50x3 | 6060-T6  | 1,680        | 0,0         | tubes_lg_reelle | Barre                   |
| 22    | 33      | 34      | RECT_50x3  | 6060-T6  | 2,334        | 0,0         | tubes_lg_reelle | Barre                   |
| 23    | 35      | 36      | RECT_50x3  | 6060-T6  | 2,334        | 0,0         | tubes_lg_reelle | Barre                   |
| 24    | 37      | 45      | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 25    | 38      | 46      | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 26    | 39      | 47      | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 27    | 40      | 48      | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 28    | 41      | 49      | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 29    | 42      | 50      | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 30    | 43      | 51      | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 31    | 44      | 52      | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 32    | 53      | 54      | RECT_50x3  | 6060-T6  | 1,680        | 0,0         | tubes_lg_reelle | Barre                   |
| 33    | 55      | 56      | RECT_50x3  | 6060-T6  | 1,680        | 0,0         | tubes_lg_reelle | Barre                   |
| 36    | 1       | 5       | RONDE_50x2 | 6060-T6  | 0,174        | 0,0         | tubes_lg_reelle | Barre                   |
| 37    | 5       | 7       | RONDE_50x2 | 6060-T6  | 0,490        | 0,0         | tubes_lg_reelle | Barre                   |
| 38    | 7       | 9       | RONDE_50x2 | 6060-T6  | 0,250        | 0,0         | tubes_lg_reelle | Barre                   |
| 39    | 9       | 11      | RONDE_50x2 | 6060-T6  | 0,880        | 0,0         | tubes_lg_reelle | Barre                   |
| 40    | 11      | 2       | RONDE_50x2 | 6060-T6  | 0,076        | 0,0         | tubes_lg_reelle | Barre                   |
| 41    | 2       | 207     | RONDE_50x2 | 6060-T6  | 0,174        | 0,0         | tubes_lg_reelle | Barre                   |
| 42    | 207     | 209     | RONDE_50x2 | 6060-T6  | 0,490        | 0,0         | tubes_lg_reelle | Barre                   |
| 43    | 209     | 211     | RONDE_50x2 | 6060-T6  | 0,250        | 0,0         | tubes_lg_reelle | Barre                   |
| 44    | 211     | 213     | RONDE_50x2 | 6060-T6  | 0,880        | 0,0         | tubes_lg_reelle | Barre                   |
| 45    | 213     | 205     | RONDE_50x2 | 6060-T6  | 0,076        | 0,0         | tubes_lg_reelle | Barre                   |
| 46    | 205     | 256     | RONDE_50x2 | 6060-T6  | 0,174        | 0,0         | tubes_lg_reelle | Barre                   |
| 47    | 256     | 258     | RONDE_50x2 | 6060-T6  | 0,490        | 0,0         | tubes_lg_reelle | Barre                   |

| Barre | Noeud 1 | Noeud 2 | Section    | Matériau | Longueur [m] | Gamma [Deg] | Type de barre   | Élément de construction |
|-------|---------|---------|------------|----------|--------------|-------------|-----------------|-------------------------|
| 48    | 258     | 260     | RONDE_50x2 | 6060-T6  | 0,250        | 0,0         | tubes_lg_reelle | Barre                   |
| 49    | 260     | 262     | RONDE_50x2 | 6060-T6  | 0,880        | 0,0         | tubes_lg_reelle | Barre                   |
| 50    | 262     | 254     | RONDE_50x2 | 6060-T6  | 0,076        | 0,0         | tubes_lg_reelle | Barre                   |
| 51    | 22      | 24      | RONDE_50x2 | 6060-T6  | 0,490        | -0,0        | tubes_lg_reelle | Barre                   |
| 52    | 24      | 26      | RONDE_50x2 | 6060-T6  | 0,250        | -0,0        | tubes_lg_reelle | Barre                   |
| 53    | 26      | 29      | RONDE_50x2 | 6060-T6  | 0,673        | -0,0        | tubes_lg_reelle | Barre                   |
| 54    | 29      | 28      | RONDE_50x2 | 6060-T6  | 0,207        | -0,0        | tubes_lg_reelle | Barre                   |
| 55    | 28      | 20      | RONDE_50x2 | 6060-T6  | 0,076        | -0,0        | tubes_lg_reelle | Barre                   |
| 56    | 20      | 220     | RONDE_50x2 | 6060-T6  | 0,174        | -0,0        | tubes_lg_reelle | Barre                   |
| 57    | 220     | 222     | RONDE_50x2 | 6060-T6  | 0,490        | -0,0        | tubes_lg_reelle | Barre                   |
| 58    | 222     | 224     | RONDE_50x2 | 6060-T6  | 0,250        | -0,0        | tubes_lg_reelle | Barre                   |
| 59    | 224     | 227     | RONDE_50x2 | 6060-T6  | 0,673        | -0,0        | tubes_lg_reelle | Barre                   |
| 60    | 227     | 226     | RONDE_50x2 | 6060-T6  | 0,207        | -0,0        | tubes_lg_reelle | Barre                   |
| 61    | 226     | 218     | RONDE_50x2 | 6060-T6  | 0,076        | -0,0        | tubes_lg_reelle | Barre                   |
| 62    | 218     | 269     | RONDE_50x2 | 6060-T6  | 0,174        | -0,0        | tubes_lg_reelle | Barre                   |
| 63    | 269     | 271     | RONDE_50x2 | 6060-T6  | 0,490        | -0,0        | tubes_lg_reelle | Barre                   |
| 64    | 271     | 273     | RONDE_50x2 | 6060-T6  | 0,250        | -0,0        | tubes_lg_reelle | Barre                   |
| 65    | 273     | 276     | RONDE_50x2 | 6060-T6  | 0,673        | -0,0        | tubes_lg_reelle | Barre                   |
| 66    | 276     | 275     | RONDE_50x2 | 6060-T6  | 0,207        | -0,0        | tubes_lg_reelle | Barre                   |
| 67    | 275     | 267     | RONDE_50x2 | 6060-T6  | 0,076        | -0,0        | tubes_lg_reelle | Barre                   |
| 68    | 21      | 23      | RONDE_50x2 | 6060-T6  | 0,490        | -0,0        | tubes_lg_reelle | Barre                   |
| 69    | 23      | 25      | RONDE_50x2 | 6060-T6  | 0,250        | -0,0        | tubes_lg_reelle | Barre                   |
| 70    | 25      | 27      | RONDE_50x2 | 6060-T6  | 0,880        | -0,0        | tubes_lg_reelle | Barre                   |
| 71    | 27      | 18      | RONDE_50x2 | 6060-T6  | 0,076        | -0,0        | tubes_lg_reelle | Barre                   |
| 72    | 18      | 219     | RONDE_50x2 | 6060-T6  | 0,174        | -0,0        | tubes_lg_reelle | Barre                   |
| 73    | 219     | 221     | RONDE_50x2 | 6060-T6  | 0,490        | -0,0        | tubes_lg_reelle | Barre                   |
| 74    | 221     | 223     | RONDE_50x2 | 6060-T6  | 0,250        | -0,0        | tubes_lg_reelle | Barre                   |
| 75    | 223     | 225     | RONDE_50x2 | 6060-T6  | 0,880        | -0,0        | tubes_lg_reelle | Barre                   |
| 76    | 225     | 217     | RONDE_50x2 | 6060-T6  | 0,076        | -0,0        | tubes_lg_reelle | Barre                   |
| 77    | 217     | 268     | RONDE_50x2 | 6060-T6  | 0,174        | -0,0        | tubes_lg_reelle | Barre                   |
| 78    | 268     | 270     | RONDE_50x2 | 6060-T6  | 0,490        | -0,0        | tubes_lg_reelle | Barre                   |
| 79    | 270     | 272     | RONDE_50x2 | 6060-T6  | 0,250        | -0,0        | tubes_lg_reelle | Barre                   |
| 80    | 272     | 274     | RONDE_50x2 | 6060-T6  | 0,880        | -0,0        | tubes_lg_reelle | Barre                   |
| 81    | 274     | 266     | RONDE_50x2 | 6060-T6  | 0,076        | -0,0        | tubes_lg_reelle | Barre                   |
| 82    | 6       | 8       | RONDE_50x2 | 6060-T6  | 0,490        | 0,0         | tubes_lg_reelle | Barre                   |
| 83    | 8       | 10      | RONDE_50x2 | 6060-T6  | 0,250        | 0,0         | tubes_lg_reelle | Barre                   |
| 84    | 10      | 13      | RONDE_50x2 | 6060-T6  | 0,673        | 0,0         | tubes_lg_reelle | Barre                   |
| 85    | 13      | 12      | RONDE_50x2 | 6060-T6  | 0,207        | 0,0         | tubes_lg_reelle | Barre                   |
| 86    | 12      | 4       | RONDE_50x2 | 6060-T6  | 0,076        | 0,0         | tubes_lg_reelle | Barre                   |
| 87    | 4       | 208     | RONDE_50x2 | 6060-T6  | 0,174        | 0,0         | tubes_lg_reelle | Barre                   |
| 88    | 208     | 210     | RONDE_50x2 | 6060-T6  | 0,490        | 0,0         | tubes_lg_reelle | Barre                   |
| 89    | 210     | 212     | RONDE_50x2 | 6060-T6  | 0,250        | 0,0         | tubes_lg_reelle | Barre                   |
| 90    | 212     | 215     | RONDE_50x2 | 6060-T6  | 0,673        | 0,0         | tubes_lg_reelle | Barre                   |
| 91    | 215     | 214     | RONDE_50x2 | 6060-T6  | 0,207        | 0,0         | tubes_lg_reelle | Barre                   |
| 92    | 214     | 206     | RONDE_50x2 | 6060-T6  | 0,076        | 0,0         | tubes_lg_reelle | Barre                   |
| 93    | 206     | 257     | RONDE_50x2 | 6060-T6  | 0,174        | 0,0         | tubes_lg_reelle | Barre                   |
| 94    | 257     | 259     | RONDE_50x2 | 6060-T6  | 0,490        | 0,0         | tubes_lg_reelle | Barre                   |
| 95    | 259     | 261     | RONDE_50x2 | 6060-T6  | 0,250        | 0,0         | tubes_lg_reelle | Barre                   |
| 96    | 261     | 264     | RONDE_50x2 | 6060-T6  | 0,673        | 0,0         | tubes_lg_reelle | Barre                   |

| Barre | Noeud 1 | Noeud 2 | Section    | Matériau | Longueur [m] | Gamma [Deg] | Type de barre   | Élément de construction |
|-------|---------|---------|------------|----------|--------------|-------------|-----------------|-------------------------|
| 97    | 264     | 263     | RONDE_50x2 | 6060-T6  | 0,207        | 0,0         | tubes_lg_reelle | Barre                   |
| 98    | 263     | 255     | RONDE_50x2 | 6060-T6  | 0,076        | 0,0         | tubes_lg_reelle | Barre                   |
| 99    | 63      | 62      | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 100   | 64      | 65      | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 101   | 66      | 67      | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 102   | 255     | 63      | RONDE_50x2 | 6060-T6  | 1,100        | 0,0         | tubes_lg_reelle | Barre                   |
| 103   | 266     | 68      | RONDE_50x2 | 6060-T6  | 1,100        | -0,0        | tubes_lg_reelle | Barre                   |
| 104   | 69      | 68      | RONDE_50x2 | 6060-T6  | 1,340        | -0,0        | tubes_lg_reelle | Barre                   |
| 105   | 70      | 71      | RONDE_50x2 | 6060-T6  | 1,340        | -0,0        | tubes_lg_reelle | Barre                   |
| 106   | 72      | 73      | RONDE_50x2 | 6060-T6  | 1,340        | -0,0        | tubes_lg_reelle | Barre                   |
| 107   | 267     | 69      | RONDE_50x2 | 6060-T6  | 1,100        | -0,0        | tubes_lg_reelle | Barre                   |
| 108   | 73      | 67      | RONDE_50x3 | 6060-T6  | 1,680        | 0,0         | tubes_lg_reelle | Barre                   |
| 109   | 68      | 62      | RONDE_50x3 | 6060-T6  | 1,680        | 0,0         | tubes_lg_reelle | Barre                   |
| 110   | 69      | 63      | RONDE_50x3 | 6060-T6  | 1,680        | 0,0         | tubes_lg_reelle | Barre                   |
| 111   | 24      | 210     | RONDE_50x3 | 6060-T6  | 2,514        | 0,0         | tubes_lg_reelle | Barre                   |
| 112   | 72      | 66      | RONDE_50x3 | 6060-T6  | 1,680        | 0,0         | tubes_lg_reelle | Barre                   |
| 113   | 222     | 259     | RONDE_50x3 | 6060-T6  | 2,514        | 0,0         | tubes_lg_reelle | Barre                   |
| 114   | 271     | 66      | RONDE_50x3 | 6060-T6  | 2,481        | 0,0         | tubes_lg_reelle | Barre                   |
| 115   | 275     | 263     | RONDE_50x3 | 6060-T6  | 1,680        | 0,0         | tubes_lg_reelle | Barre                   |
| 116   | 74      | 75      | RONDE_50x2 | 6060-T6  | 2,509        | 0,0         | tubes_lg_reelle | Barre                   |
| 117   | 21      | 75      | RONDE_50x2 | 6060-T6  | 1,960        | 0,0         | tubes_lg_reelle | Barre                   |
| 118   | 77      | 78      | RONDE_50x2 | 6060-T6  | 2,509        | 0,0         | tubes_lg_reelle | Barre                   |
| 119   | 6       | 78      | RONDE_50x2 | 6060-T6  | 1,960        | 0,0         | tubes_lg_reelle | Barre                   |
| 120   | 22      | 79      | RONDE_50x2 | 6060-T6  | 1,960        | 0,0         | tubes_lg_reelle | Barre                   |
| 121   | 80      | 79      | RONDE_50x2 | 6060-T6  | 2,509        | 0,0         | tubes_lg_reelle | Barre                   |
| 122   | 81      | 82      | RONDE_50x2 | 6060-T6  | 2,509        | 0,0         | tubes_lg_reelle | Barre                   |
| 123   | 5       | 82      | RONDE_50x2 | 6060-T6  | 1,960        | 0,0         | tubes_lg_reelle | Barre                   |
| 127   | 207     | 208     | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 128   | 209     | 210     | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 129   | 211     | 212     | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 130   | 213     | 214     | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 131   | 215     | 216     | RONDE_30x2 | 6060-T6  | 0,950        | 0,0         | tubes_lg_reelle | Barre                   |
| 134   | 219     | 220     | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 135   | 221     | 222     | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 136   | 223     | 224     | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 137   | 225     | 226     | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 138   | 227     | 228     | RONDE_30x2 | 6060-T6  | 0,950        | -0,0        | tubes_lg_reelle | Barre                   |
| 139   | 219     | 207     | RONDE_50x3 | 6060-T6  | 1,680        | 0,0         | tubes_lg_reelle | Barre                   |
| 140   | 220     | 208     | RONDE_50x3 | 6060-T6  | 1,680        | 0,0         | tubes_lg_reelle | Barre                   |
| 141   | 225     | 213     | RONDE_50x3 | 6060-T6  | 1,680        | 0,0         | tubes_lg_reelle | Barre                   |
| 142   | 229     | 230     | RECT_50x3  | 6060-T6  | 2,334        | 0,0         | tubes_lg_reelle | Barre                   |
| 143   | 231     | 232     | RECT_50x3  | 6060-T6  | 2,334        | 0,0         | tubes_lg_reelle | Barre                   |
| 144   | 233     | 234     | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 145   | 235     | 236     | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 146   | 237     | 238     | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 147   | 239     | 240     | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 148   | 241     | 242     | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 149   | 243     | 244     | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 150   | 245     | 246     | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |

| Barre | Noeud 1 | Noeud 2 | Section    | Matériau | Longueur [m] | Gamma [Deg] | Type de barre   | Élément de construction |
|-------|---------|---------|------------|----------|--------------|-------------|-----------------|-------------------------|
| 151   | 247     | 248     | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 152   | 249     | 250     | RECT_50x3  | 6060-T6  | 1,680        | 0,0         | tubes_lg_reelle | Barre                   |
| 153   | 251     | 252     | RECT_50x3  | 6060-T6  | 1,680        | 0,0         | tubes_lg_reelle | Barre                   |
| 157   | 256     | 257     | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 158   | 258     | 259     | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 159   | 260     | 261     | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 160   | 262     | 263     | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 161   | 264     | 265     | RONDE_30x2 | 6060-T6  | 0,950        | 0,0         | tubes_lg_reelle | Barre                   |
| 164   | 268     | 269     | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 165   | 270     | 271     | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 166   | 272     | 273     | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 167   | 274     | 275     | RONDE_50x2 | 6060-T6  | 1,340        | 0,0         | tubes_lg_reelle | Barre                   |
| 168   | 276     | 277     | RONDE_30x2 | 6060-T6  | 0,950        | -0,0        | tubes_lg_reelle | Barre                   |
| 169   | 268     | 256     | RONDE_50x3 | 6060-T6  | 1,680        | 0,0         | tubes_lg_reelle | Barre                   |
| 170   | 269     | 257     | RONDE_50x3 | 6060-T6  | 1,680        | 0,0         | tubes_lg_reelle | Barre                   |
| 171   | 274     | 262     | RONDE_50x3 | 6060-T6  | 1,680        | 0,0         | tubes_lg_reelle | Barre                   |
| 172   | 278     | 279     | RECT_50x3  | 6060-T6  | 2,334        | 0,0         | tubes_lg_reelle | Barre                   |
| 173   | 280     | 281     | RECT_50x3  | 6060-T6  | 2,334        | 0,0         | tubes_lg_reelle | Barre                   |
| 174   | 282     | 283     | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 175   | 284     | 285     | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 176   | 286     | 287     | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 177   | 288     | 289     | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 178   | 290     | 291     | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 179   | 292     | 293     | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 180   | 294     | 295     | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 181   | 296     | 297     | marc 60    | 6060-T6  | 0,345        | -89,9       | tubes_lg_reelle | Barre                   |
| 182   | 298     | 299     | RECT_50x3  | 6060-T6  | 1,680        | 0,0         | tubes_lg_reelle | Barre                   |
| 183   | 300     | 301     | RECT_50x3  | 6060-T6  | 1,680        | 0,0         | tubes_lg_reelle | Barre                   |



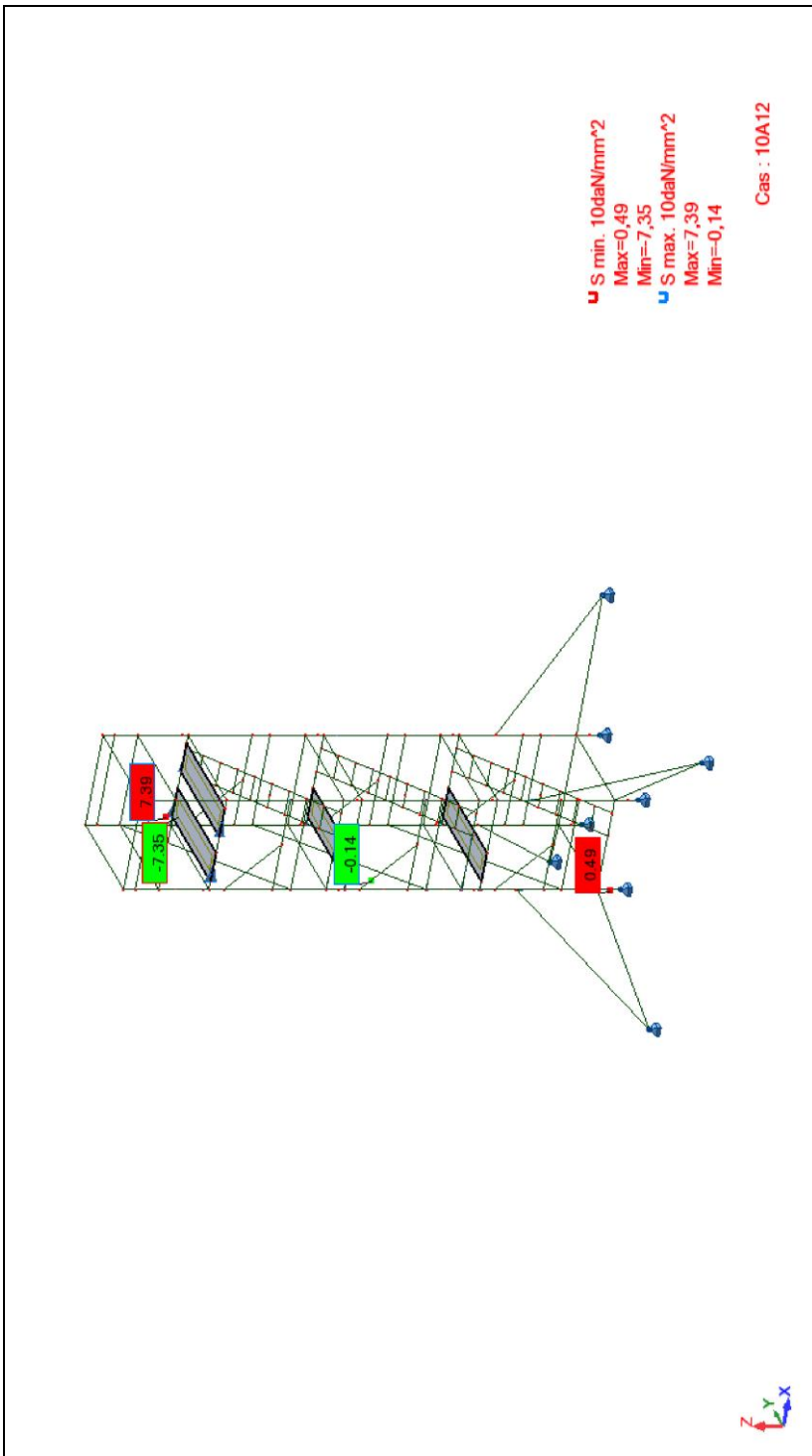
## Charges

| Cas | Préfixe | Nature       | Type de charge       | Liste                                  |
|-----|---------|--------------|----------------------|--|
| 1   | GRP1    | Structurelle | poids propre         | 1A123 127A131 134A154 157A161 16-4A184 |
| 2   | GRP2    | Catégorie E  | surfamique sur objet | 35 184                                 |
| 3   | GRP3    | vent         | force sur barre      | 171                                    |
| 4   | GRP4    | vent         | charge uniforme      | 1 2 8A11 17 18 36A98 102 103 107       |
| 4   | GRP4    | vent         | charge uniforme      | 19 20 108A110 112 139 140 169 170      |
| 4   | GRP4    | vent         | charge uniforme      | 171                                    |
| 4   | GRP4    | vent         | force sur barre      | 171                                    |
| 5   | GRP5    | Structurelle | force sur barre      | 171                                    |
| 6   | GRP2-   | Catégorie E  | force sur barre      | 115                                    |

### Suites des valeurs :

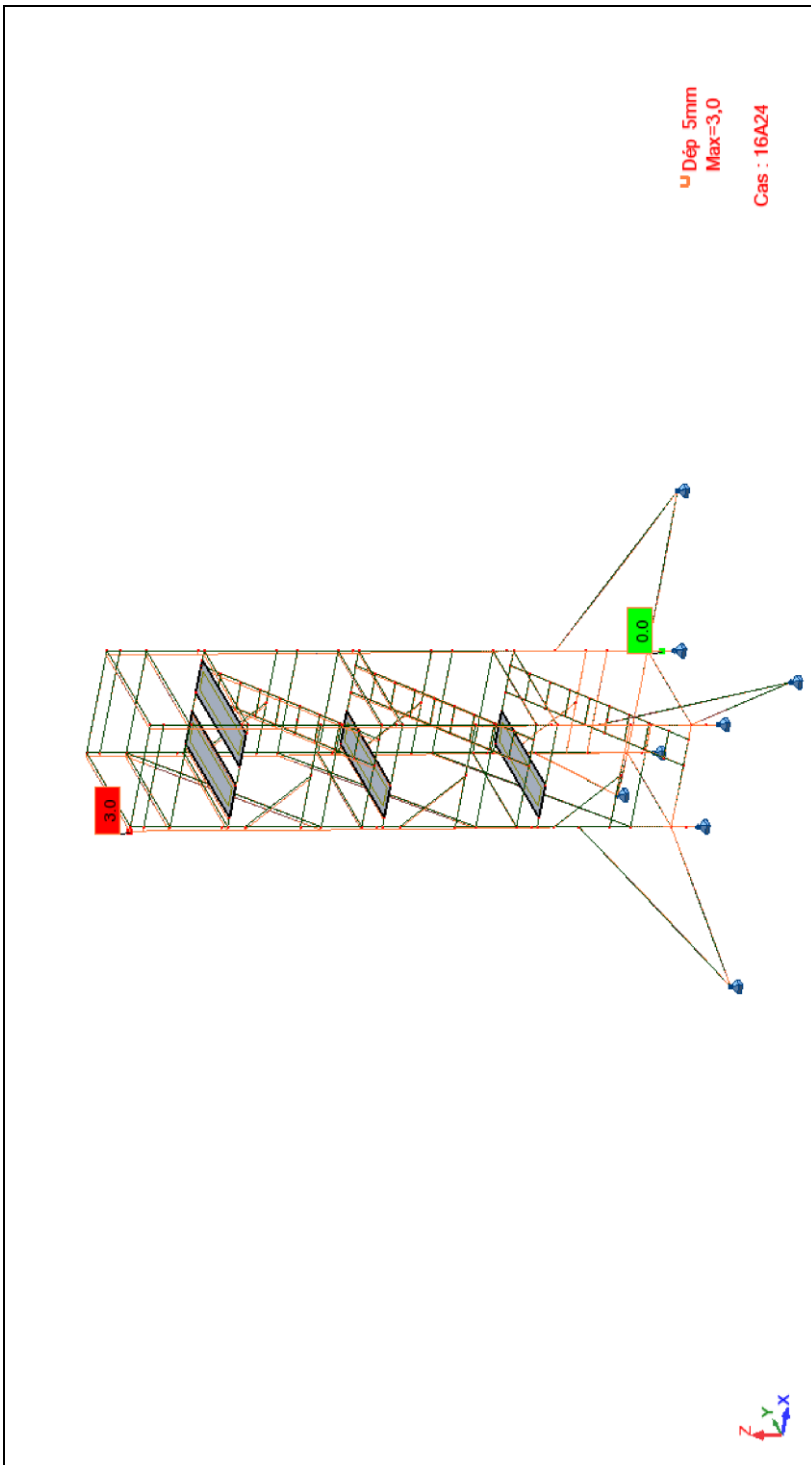
| Cas | Valeurs de la charge             | Remarques utilisateur               |
|-----|----------------------------------|-------------------------------------|
| 1   | PZ Moins Coef=2,66               |                                     |
| 2   | PZ=-200,00[daN/m <sup>2</sup> ]  | Classe3:200daN/m <sup>2</sup> §2.12 |
| 3   | FX=-30,00[daN] X=0,500 relatives | §3.1                                |
| 4   | PX=-0,70[daN/m]                  | Vent X- Montants                    |
| 4   | PX=-0,60[daN/m]                  | Vent X- lisses                      |
| 4   | PX=-4,16[daN/m]                  | Vent plancher sup                   |
| 4   | FX=-7,00[daN] X=0,500 relatives  | CH.H hommes 0.7m <sup>2</sup>       |
| 5   | FX=-8,00[daN] X=0,500 relatives  | resultante inclinaison 1%           |
| 6   | FZ=-75,00[daN] X=0,500 relatives | CH.V 75daN §11.4.2.2.2              |

## Sigma ELU - S max;S min; Cas : 10A12



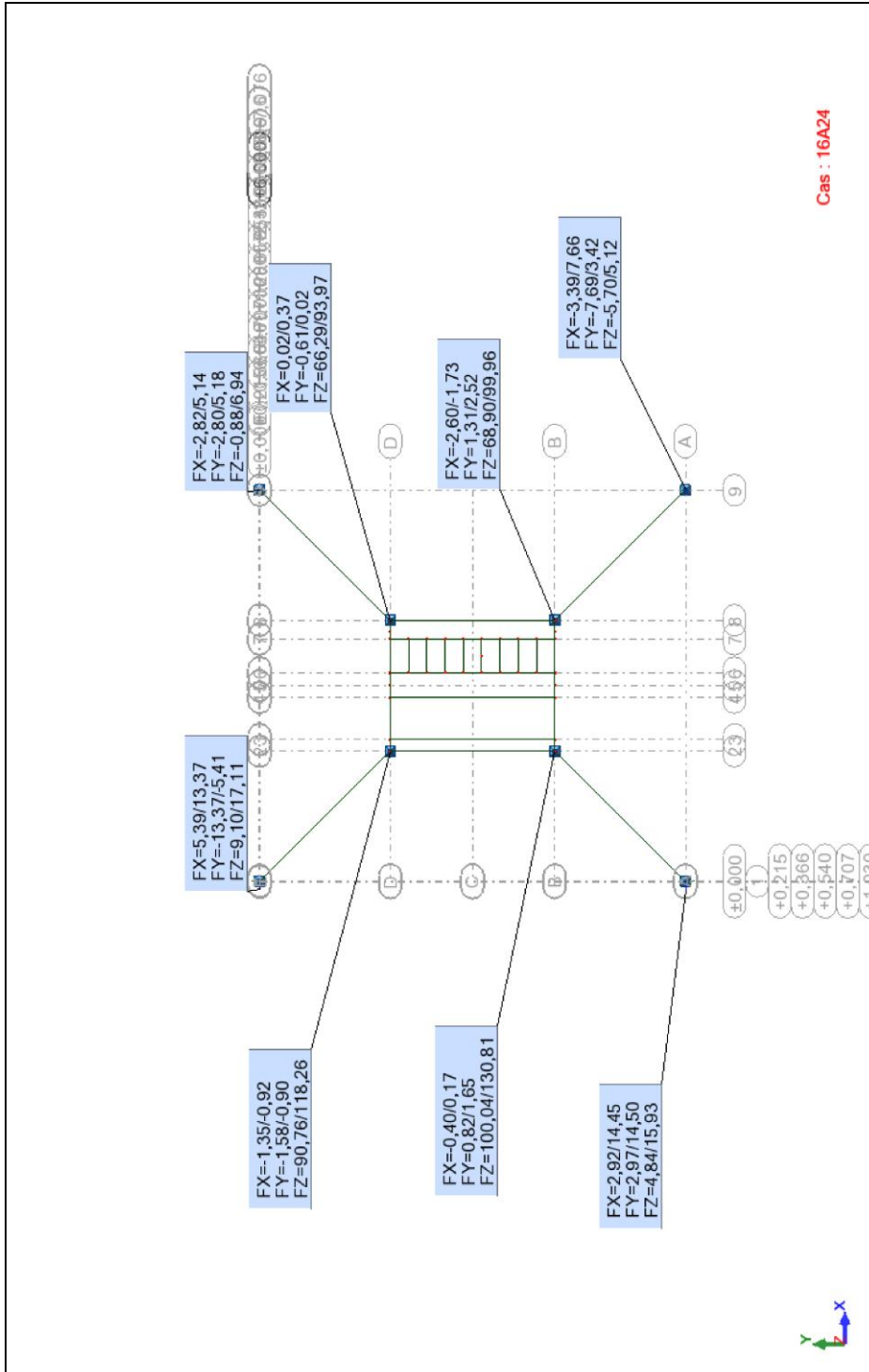
7.4<21.5daN/mm<sup>2</sup>, correct

## Fleche ELS - Déformée;Déformée exacte; Cas : 16A24



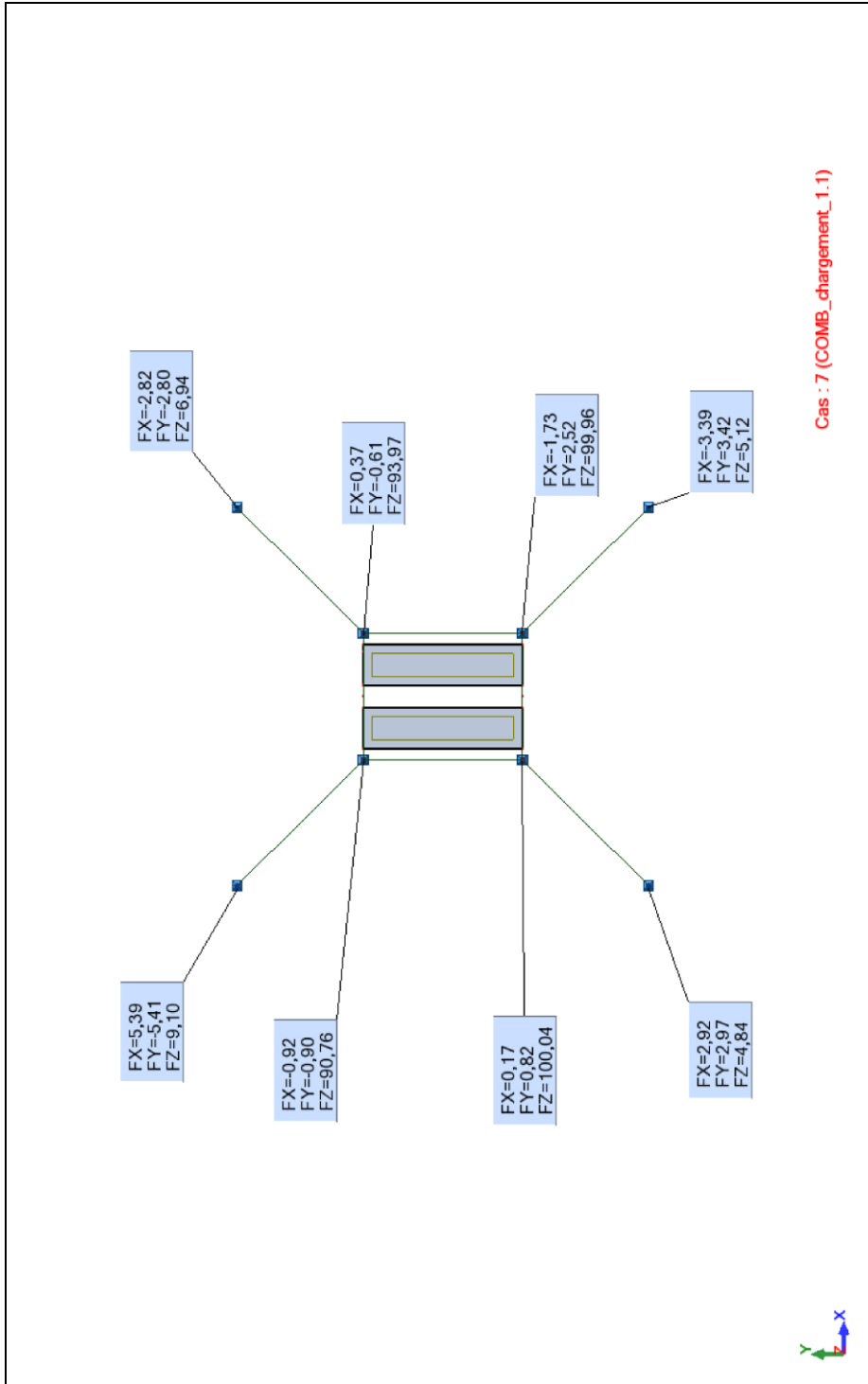
3 <200mm, correct

## Reactions ELS - Forces de réaction(daN);Moments de réaction(daN\*m); Cas : 16A24



Les quatre appuis FZ du coté X- sont supérieurs à 0 dans leur domaines mini, correct.

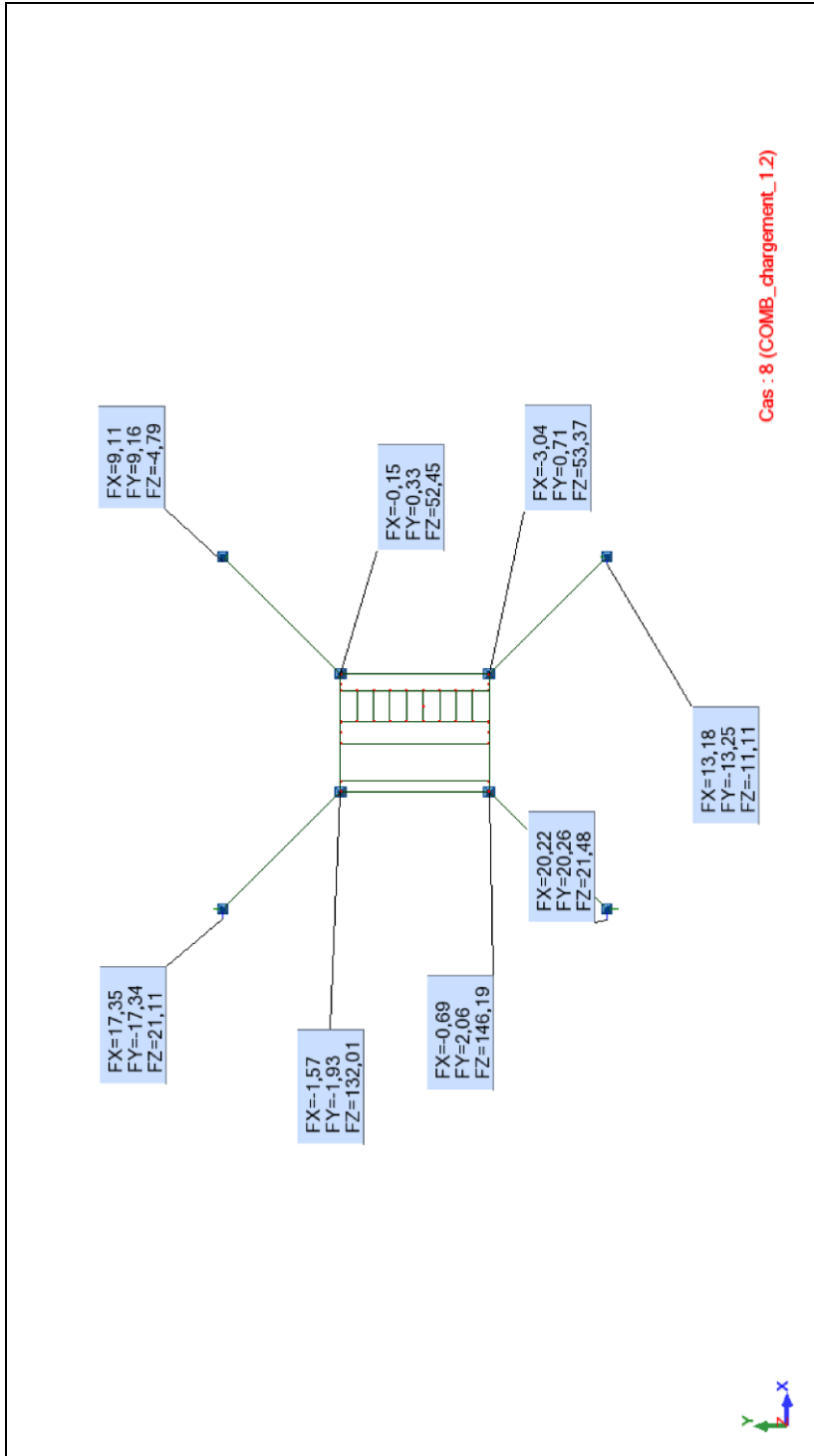
## Reactions Stabilité de position §11.4 - Forces de réaction(daN);Moments de réaction(daN\*m); Cas : 7 (COMB\_chargement\_1.1)



Cas : 7 (COMB\_chargement\_1.1)

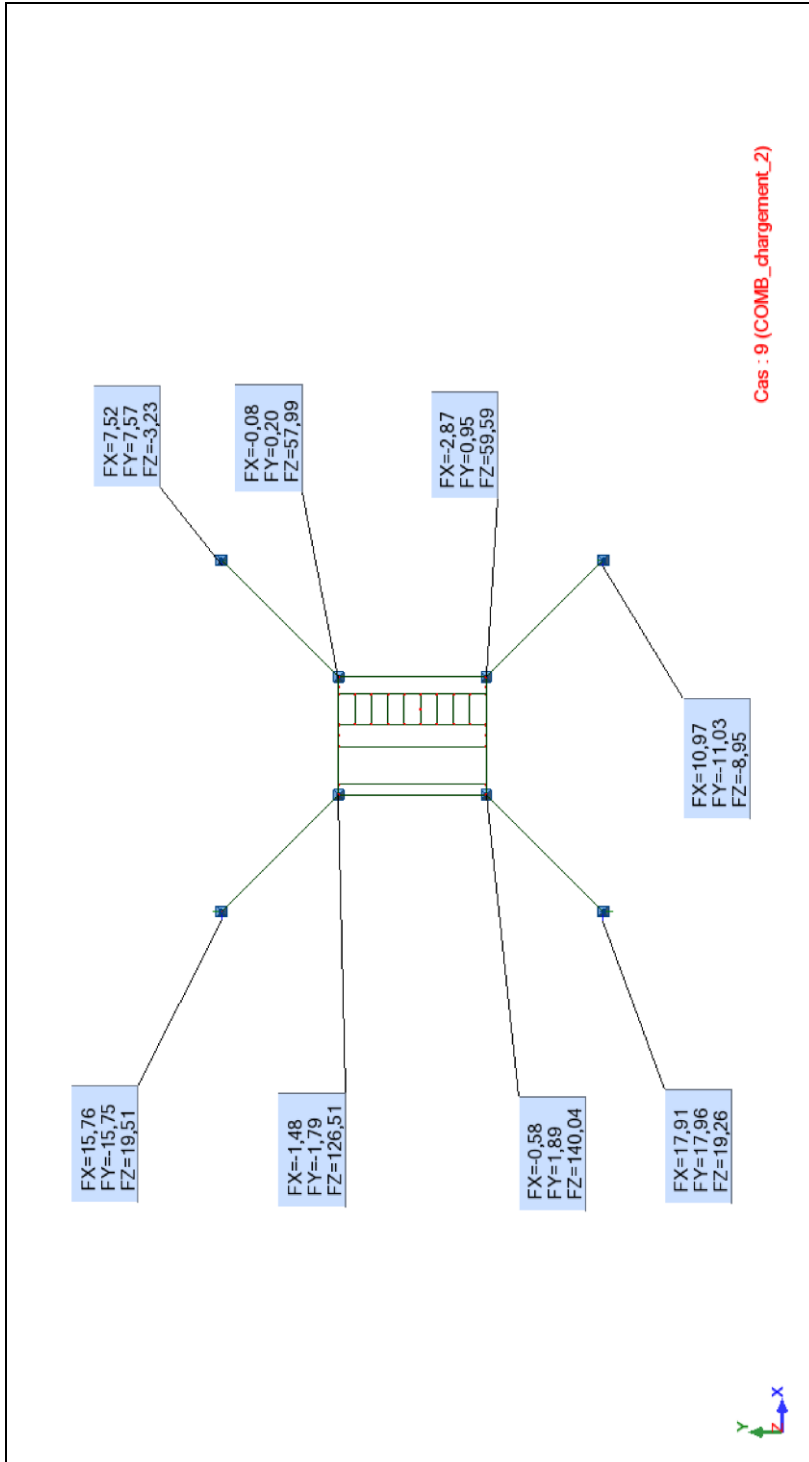
Les quatre appuis FZ du coté X- sont supérieurs à 0 dans leur domaines mini, correct.

## Reactions Stabilité de position §11.4 - Forces de réaction(daN);Moments de réaction(daN\*m); Cas : 8 (COMB\_chargement\_1.2)



Les quatre appuis FZ du coté X- sont supérieurs à 0 dans leur domaines mini, correct.

## Reactions Stabilité de position §11.4 - Forces de réaction(daN);Moments de réaction(daN\*m); Cas : 9 (COMB\_chargement\_2)



Les quatre appuis FZ du coté X- sont supérieurs à 0 dans leur domaines mini, correct.

## **Conclusion :**

Au vu du respect des hypothèses de calculs, l'installation est correctement dimensionnée et respecte les §8-§11 de la norme EN1004 :2005-05.

Le respect des documents cités dans les hypothèses de calculs seront à prendre en compte en complément de cette note de calculs.



## Annexe1: Résumé de Verif aux EC9

| Pièce                    | Profil         | Matériau | Lay        | Laz        | Ratio | Cas    | Ratio (uy) | Cas (uy)                     |
|--------------------------|----------------|----------|------------|------------|-------|--------|------------|------------------------------|
| 1                        | RONDE_50<br>x2 | 6060-T6  | 10.24      | 10.24      | 0.02  | 1 GRP1 | 0.00       | 8<br>COMB_chargemen<br>t_1.2 |
| 2<br>tubes_lg_reelle_2   | RONDE_50<br>x2 | 6060-T6  | 64.76      | 64.76      | 0.02  | 1 GRP1 | 0.00       | 8<br>COMB_chargemen<br>t_1.2 |
| 3<br>tubes_lg_reelle_3   | RONDE_50<br>x2 | 6060-T6  | 78.89      | 78.89      | 0.00  | 1 GRP1 | 0.00       | 8<br>COMB_chargemen<br>t_1.2 |
| 4<br>tubes_lg_reelle_4   | RONDE_50<br>x2 | 6060-T6  | 78.89      | 78.89      | 0.01  | 4 GRP4 | 0.00       | 8<br>COMB_chargemen<br>t_1.2 |
| 5<br>tubes_lg_reelle_5   | RONDE_50<br>x2 | 6060-T6  | 78.89      | 78.89      | 0.02  | 4 GRP4 | 0.00       | 8<br>COMB_chargemen<br>t_1.2 |
| 6<br>tubes_lg_reelle_6   | RONDE_50<br>x2 | 6060-T6  | 78.89      | 78.89      | 0.03  | 4 GRP4 | 0.01       | 1.5*4 + 1*6                  |
| 7<br>tubes_lg_reelle_7   | RONDE_30<br>x2 | 6060-T6  | 95.69      | 95.69      | 0.00  | 4 GRP4 | 0.02       | 8<br>COMB_chargemen<br>t_1.2 |
| 8<br>tubes_lg_reelle_8   | tf_m30x5       | 6060-T6  | 24.16      | 24.16      | 0.01  | 1 GRP1 | 0.00       | 4 GRP4                       |
| 9<br>tubes_lg_reelle_9   | tf_m30x5       | 6060-T6  | 24.16      | 24.16      | 0.01  | 1 GRP1 | 0.00       | 8<br>COMB_chargemen<br>t_1.2 |
| 10<br>tubes_lg_reelle_10 | RONDE_50<br>x2 | 6060-T6  | 10.24      | 10.24      | 0.02  | 1 GRP1 | 0.00       | 8<br>COMB_chargemen<br>t_1.2 |
| 11<br>tubes_lg_reelle_11 | RONDE_50<br>x2 | 6060-T6  | 10.24      | 10.24      | 0.03  | 1 GRP1 | 0.00       | 1 GRP1                       |
| 12<br>tubes_lg_reelle_12 | RONDE_50<br>x2 | 6060-T6  | 78.89      | 78.89      | 0.02  | 1 GRP1 | 0.01       | 1.5*4 + 1*6                  |
| 13<br>tubes_lg_reelle_13 | RONDE_50<br>x2 | 6060-T6  | 78.89      | 78.89      | 0.01  | 4 GRP4 | 0.00       | 8<br>COMB_chargemen<br>t_1.2 |
| 14<br>tubes_lg_reelle_14 | RONDE_50<br>x2 | 6060-T6  | 78.89      | 78.89      | 0.02  | 4 GRP4 | 0.00       | 8<br>COMB_chargemen<br>t_1.2 |
| 15<br>tubes_lg_reelle_15 | RONDE_50<br>x2 | 6060-T6  | 78.89      | 78.89      | 0.03  | 4 GRP4 | 0.01       | 1.5*4 + 1*6                  |
| 16<br>tubes_lg_reelle_16 | RONDE_30<br>x2 | 6060-T6  | 95.69      | 95.69      | 0.01  | 4 GRP4 | 0.02       | 8<br>COMB_chargemen<br>t_1.2 |
| 17<br>tubes_lg_reelle_17 | tf_m30x5       | 6060-T6  | 24.16      | 24.16      | 0.02  | 1 GRP1 | 0.07       | 1.5*4 + 1*6                  |
| 18<br>tubes_lg_reelle_18 | tf_m30x5       | 6060-T6  | 24.16      | 24.16      | 0.01  | 1 GRP1 | 0.00       | 8<br>COMB_chargemen<br>t_1.2 |
| 19<br>tubes_lg_reelle_19 | RONDE_50<br>x3 | 6060-T6  | 100.9<br>0 | 100.9<br>0 | 0.01  | 1 GRP1 | 0.00       | 1.5*4 + 1*6                  |
| 20<br>tubes_lg_reelle_20 | RONDE_50<br>x3 | 6060-T6  | 100.9<br>0 | 100.9<br>0 | 0.01  | 1 GRP1 | 0.00       | 3 GRP3                       |
| 21<br>tubes_lg_reelle_21 | RONDE_50<br>x3 | 6060-T6  | 100.9<br>0 | 100.9<br>0 | 0.00  | 4 GRP4 | 0.00       | 1.5*4 + 1*6                  |
| 22<br>tubes_lg_reelle_22 | RECT_50x3      | 6060-T6  | 121.3<br>9 | 121.3<br>9 | 0.01  | 1 GRP1 | 0.00       | 8<br>COMB_chargemen          |

|                          |                |         |            |            |      |        |      |                              |
|--------------------------|----------------|---------|------------|------------|------|--------|------|------------------------------|
|                          |                |         |            |            |      |        |      | t_1.2                        |
| 23<br>tubes_lg_reelle_23 | RECT_50x3      | 6060-T6 | 121.3<br>9 | 121.3<br>9 | 0.01 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 24<br>tubes_lg_reelle_24 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.01 | 1 GRP1 | 0.00 | 1 GRP1                       |
| 25<br>tubes_lg_reelle_25 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.01 | 1 GRP1 | 0.00 | 1 GRP1                       |
| 26<br>tubes_lg_reelle_26 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.01 | 1 GRP1 | 0.00 | 1.5*4 + 1*6                  |
| 27<br>tubes_lg_reelle_27 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.02 | 1 GRP1 | 0.00 | 1.5*4 + 1*6                  |
| 28<br>tubes_lg_reelle_28 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.02 | 1 GRP1 | 0.00 | 1.5*4 + 1*6                  |
| 29<br>tubes_lg_reelle_29 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.02 | 1 GRP1 | 0.00 | 1.5*4 + 1*6                  |
| 30<br>tubes_lg_reelle_30 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.01 | 1 GRP1 | 0.00 | 1.5*4 + 1*6                  |
| 31<br>tubes_lg_reelle_31 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.01 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 32<br>tubes_lg_reelle_32 | RECT_50x3      | 6060-T6 | 87.38      | 87.38      | 0.00 | 4 GRP4 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 33<br>tubes_lg_reelle_33 | RECT_50x3      | 6060-T6 | 87.38      | 87.38      | 0.00 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 36<br>tubes_lg_reelle_36 | RONDE_50<br>x2 | 6060-T6 | 10.24      | 10.24      | 0.02 | 1 GRP1 | 0.00 | 4 GRP4                       |
| 37<br>tubes_lg_reelle_37 | RONDE_50<br>x2 | 6060-T6 | 28.85      | 28.85      | 0.02 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 38<br>tubes_lg_reelle_38 | RONDE_50<br>x2 | 6060-T6 | 14.72      | 14.72      | 0.02 | 1 GRP1 | 0.00 | 1 GRP1                       |
| 39<br>tubes_lg_reelle_39 | RONDE_50<br>x2 | 6060-T6 | 51.81      | 51.81      | 0.03 | 1 GRP1 | 0.02 | 8<br>COMB_chargemen<br>t_1.2 |
| 40<br>tubes_lg_reelle_40 | RONDE_50<br>x2 | 6060-T6 | 4.47       | 4.47       | 0.03 | 1 GRP1 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 41<br>tubes_lg_reelle_41 | RONDE_50<br>x2 | 6060-T6 | 10.24      | 10.24      | 0.02 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 42<br>tubes_lg_reelle_42 | RONDE_50<br>x2 | 6060-T6 | 28.85      | 28.85      | 0.01 | 1 GRP1 | 0.00 | 1.5*4 + 1*6                  |
| 43<br>tubes_lg_reelle_43 | RONDE_50<br>x2 | 6060-T6 | 14.72      | 14.72      | 0.01 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 44<br>tubes_lg_reelle_44 | RONDE_50<br>x2 | 6060-T6 | 51.81      | 51.81      | 0.02 | 1 GRP1 | 0.01 | 1 GRP1                       |
| 45<br>tubes_lg_reelle_45 | RONDE_50<br>x2 | 6060-T6 | 4.47       | 4.47       | 0.03 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 46<br>tubes_lg_reelle_46 | RONDE_50<br>x2 | 6060-T6 | 10.24      | 10.24      | 0.02 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 47<br>tubes_lg_reelle_47 | RONDE_50<br>x2 | 6060-T6 | 28.85      | 28.85      | 0.01 | 1 GRP1 | 0.00 | 3 GRP3                       |
| 48<br>tubes_lg_reelle_48 | RONDE_50<br>x2 | 6060-T6 | 14.72      | 14.72      | 0.01 | 3 GRP3 | 0.00 | 1.5*4 + 1*6                  |
| 49<br>tubes_lg_reelle_49 | RONDE_50<br>x2 | 6060-T6 | 51.81      | 51.81      | 0.02 | 1 GRP1 | 0.01 | 1 GRP1                       |

|                          |                |         |       |       |      |        |      |                              |
|--------------------------|----------------|---------|-------|-------|------|--------|------|------------------------------|
| 50<br>tubes_lg_reelle_50 | RONDE_50<br>x2 | 6060-T6 | 4.47  | 4.47  | 0.02 | 1 GRP1 | 0.01 | 1.5*4 + 1*6                  |
| 51<br>tubes_lg_reelle_51 | RONDE_50<br>x2 | 6060-T6 | 28.85 | 28.85 | 0.02 | 1 GRP1 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 52<br>tubes_lg_reelle_52 | RONDE_50<br>x2 | 6060-T6 | 14.72 | 14.72 | 0.02 | 1 GRP1 | 0.00 | 1 GRP1                       |
| 53<br>tubes_lg_reelle_53 | RONDE_50<br>x2 | 6060-T6 | 39.62 | 39.62 | 0.04 | 4 GRP4 | 0.04 | 8<br>COMB_chargemen<br>t_1.2 |
| 54<br>tubes_lg_reelle_54 | RONDE_50<br>x2 | 6060-T6 | 12.19 | 12.19 | 0.03 | 4 GRP4 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 55<br>tubes_lg_reelle_55 | RONDE_50<br>x2 | 6060-T6 | 4.47  | 4.47  | 0.02 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 56<br>tubes_lg_reelle_56 | RONDE_50<br>x2 | 6060-T6 | 10.24 | 10.24 | 0.02 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 57<br>tubes_lg_reelle_57 | RONDE_50<br>x2 | 6060-T6 | 28.85 | 28.85 | 0.03 | 4 GRP4 | 0.00 | 1.5*4 + 1*6                  |
| 58<br>tubes_lg_reelle_58 | RONDE_50<br>x2 | 6060-T6 | 14.72 | 14.72 | 0.02 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 59<br>tubes_lg_reelle_59 | RONDE_50<br>x2 | 6060-T6 | 39.62 | 39.62 | 0.02 | 3 GRP3 | 0.00 | 1 GRP1                       |
| 60<br>tubes_lg_reelle_60 | RONDE_50<br>x2 | 6060-T6 | 12.19 | 12.19 | 0.02 | 3 GRP3 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 61<br>tubes_lg_reelle_61 | RONDE_50<br>x2 | 6060-T6 | 4.47  | 4.47  | 0.02 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 62<br>tubes_lg_reelle_62 | RONDE_50<br>x2 | 6060-T6 | 10.24 | 10.24 | 0.02 | 1 GRP1 | 0.00 | 1.5*4 + 1*6                  |
| 63<br>tubes_lg_reelle_63 | RONDE_50<br>x2 | 6060-T6 | 28.85 | 28.85 | 0.02 | 3 GRP3 | 0.01 | 1.5*4 + 1*6                  |
| 64<br>tubes_lg_reelle_64 | RONDE_50<br>x2 | 6060-T6 | 14.72 | 14.72 | 0.01 | 1 GRP1 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 65<br>tubes_lg_reelle_65 | RONDE_50<br>x2 | 6060-T6 | 39.62 | 39.62 | 0.01 | 3 GRP3 | 0.04 | 8<br>COMB_chargemen<br>t_1.2 |
| 66<br>tubes_lg_reelle_66 | RONDE_50<br>x2 | 6060-T6 | 12.19 | 12.19 | 0.02 | 3 GRP3 | 0.03 | 8<br>COMB_chargemen<br>t_1.2 |
| 67<br>tubes_lg_reelle_67 | RONDE_50<br>x2 | 6060-T6 | 4.47  | 4.47  | 0.01 | 1 GRP1 | 0.02 | 8<br>COMB_chargemen<br>t_1.2 |
| 68<br>tubes_lg_reelle_68 | RONDE_50<br>x2 | 6060-T6 | 28.85 | 28.85 | 0.02 | 1 GRP1 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 69<br>tubes_lg_reelle_69 | RONDE_50<br>x2 | 6060-T6 | 14.72 | 14.72 | 0.02 | 1 GRP1 | 0.00 | 4 GRP4                       |
| 70<br>tubes_lg_reelle_70 | RONDE_50<br>x2 | 6060-T6 | 51.81 | 51.81 | 0.02 | 1 GRP1 | 0.04 | 8<br>COMB_chargemen<br>t_1.2 |
| 71<br>tubes_lg_reelle_71 | RONDE_50<br>x2 | 6060-T6 | 4.47  | 4.47  | 0.02 | 1 GRP1 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 72<br>tubes_lg_reelle_72 | RONDE_50<br>x2 | 6060-T6 | 10.24 | 10.24 | 0.03 | 1 GRP1 | 0.00 | 1.5*4 + 1*6                  |
| 73<br>tubes_lg_reelle_73 | RONDE_50       | 6060-T6 | 28.85 | 28.85 | 0.01 | 1 GRP1 | 0.01 | 8                            |

|                          |                |         |       |       |      |        |      |                              |
|--------------------------|----------------|---------|-------|-------|------|--------|------|------------------------------|
| tubes_lg_reelle_73       | x2             |         |       |       |      |        |      | COMB_chargemen<br>t_1.2      |
| 74<br>tubes_lg_reelle_74 | RONDE_50<br>x2 | 6060-T6 | 14.72 | 14.72 | 0.01 | 1 GRP1 | 0.00 | 1.5*4 + 1*6                  |
| 75<br>tubes_lg_reelle_75 | RONDE_50<br>x2 | 6060-T6 | 51.81 | 51.81 | 0.01 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 76<br>tubes_lg_reelle_76 | RONDE_50<br>x2 | 6060-T6 | 4.47  | 4.47  | 0.02 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 77<br>tubes_lg_reelle_77 | RONDE_50<br>x2 | 6060-T6 | 10.24 | 10.24 | 0.03 | 1 GRP1 | 0.00 | 1 GRP1                       |
| 78<br>tubes_lg_reelle_78 | RONDE_50<br>x2 | 6060-T6 | 28.85 | 28.85 | 0.01 | 1 GRP1 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 79<br>tubes_lg_reelle_79 | RONDE_50<br>x2 | 6060-T6 | 14.72 | 14.72 | 0.01 | 3 GRP3 | 0.00 | 1 GRP1                       |
| 80<br>tubes_lg_reelle_80 | RONDE_50<br>x2 | 6060-T6 | 51.81 | 51.81 | 0.01 | 1 GRP1 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 81<br>tubes_lg_reelle_81 | RONDE_50<br>x2 | 6060-T6 | 4.47  | 4.47  | 0.01 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 82<br>tubes_lg_reelle_82 | RONDE_50<br>x2 | 6060-T6 | 28.85 | 28.85 | 0.02 | 1 GRP1 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 83<br>tubes_lg_reelle_83 | RONDE_50<br>x2 | 6060-T6 | 14.72 | 14.72 | 0.02 | 1 GRP1 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 84<br>tubes_lg_reelle_84 | RONDE_50<br>x2 | 6060-T6 | 39.62 | 39.62 | 0.03 | 4 GRP4 | 0.05 | 8<br>COMB_chargemen<br>t_1.2 |
| 85<br>tubes_lg_reelle_85 | RONDE_50<br>x2 | 6060-T6 | 12.19 | 12.19 | 0.03 | 4 GRP4 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 86<br>tubes_lg_reelle_86 | RONDE_50<br>x2 | 6060-T6 | 4.47  | 4.47  | 0.02 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 87<br>tubes_lg_reelle_87 | RONDE_50<br>x2 | 6060-T6 | 10.24 | 10.24 | 0.02 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 88<br>tubes_lg_reelle_88 | RONDE_50<br>x2 | 6060-T6 | 28.85 | 28.85 | 0.03 | 4 GRP4 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 89<br>tubes_lg_reelle_89 | RONDE_50<br>x2 | 6060-T6 | 14.72 | 14.72 | 0.02 | 1 GRP1 | 0.01 | 1.5*4 + 1*6                  |
| 90<br>tubes_lg_reelle_90 | RONDE_50<br>x2 | 6060-T6 | 39.62 | 39.62 | 0.02 | 3 GRP3 | 0.00 | 1.5*4 + 1*6                  |
| 91<br>tubes_lg_reelle_91 | RONDE_50<br>x2 | 6060-T6 | 12.19 | 12.19 | 0.02 | 4 GRP4 | 0.00 | 1 GRP1                       |
| 92<br>tubes_lg_reelle_92 | RONDE_50<br>x2 | 6060-T6 | 4.47  | 4.47  | 0.02 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 93<br>tubes_lg_reelle_93 | RONDE_50<br>x2 | 6060-T6 | 10.24 | 10.24 | 0.02 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 94<br>tubes_lg_reelle_94 | RONDE_50<br>x2 | 6060-T6 | 28.85 | 28.85 | 0.02 | 3 GRP3 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 95<br>tubes_lg_reelle_95 | RONDE_50<br>x2 | 6060-T6 | 14.72 | 14.72 | 0.01 | 1 GRP1 | 0.00 | 1 GRP1                       |
| 96                       | RONDE_50       | 6060-T6 | 39.62 | 39.62 | 0.01 | 1 GRP1 | 0.04 | 8                            |

|                                |                |         |            |            |      |        |      |                              |
|--------------------------------|----------------|---------|------------|------------|------|--------|------|------------------------------|
| tubes_lg_reelle_96             | x2             |         |            |            |      |        |      | COMB_chargemen<br>t_1.2      |
| 97<br>tubes_lg_reelle_97       | RONDE_50<br>x2 | 6060-T6 | 12.19      | 12.19      | 0.02 | 3 GRP3 | 0.03 | 8<br>COMB_chargemen<br>t_1.2 |
| 98<br>tubes_lg_reelle_98       | RONDE_50<br>x2 | 6060-T6 | 4.47       | 4.47       | 0.01 | 1 GRP1 | 0.02 | 8<br>COMB_chargemen<br>t_1.2 |
| 99<br>tubes_lg_reelle_99       | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.00 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 100<br>tubes_lg_reelle_10<br>0 | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.00 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 101<br>tubes_lg_reelle_10<br>1 | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.01 | 3 GRP3 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 102<br>tubes_lg_reelle_10<br>2 | RONDE_50<br>x2 | 6060-T6 | 64.76      | 64.76      | 0.01 | 1 GRP1 | 0.02 | 8<br>COMB_chargemen<br>t_1.2 |
| 103<br>tubes_lg_reelle_10<br>3 | RONDE_50<br>x2 | 6060-T6 | 64.76      | 64.76      | 0.01 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 104<br>tubes_lg_reelle_10<br>4 | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.00 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 105<br>tubes_lg_reelle_10<br>5 | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.00 | 4 GRP4 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 106<br>tubes_lg_reelle_10<br>6 | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.00 | 1 GRP1 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 107<br>tubes_lg_reelle_10<br>7 | RONDE_50<br>x2 | 6060-T6 | 64.76      | 64.76      | 0.01 | 1 GRP1 | 0.02 | 8<br>COMB_chargemen<br>t_1.2 |
| 108<br>tubes_lg_reelle_10<br>8 | RONDE_50<br>x3 | 6060-T6 | 100.9<br>0 | 100.9<br>0 | 0.00 | 3 GRP3 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 109<br>tubes_lg_reelle_10<br>9 | RONDE_50<br>x3 | 6060-T6 | 100.9<br>0 | 100.9<br>0 | 0.01 | 1 GRP1 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 110<br>tubes_lg_reelle_11<br>0 | RONDE_50<br>x3 | 6060-T6 | 100.9<br>0 | 100.9<br>0 | 0.01 | 1 GRP1 | 0.00 | 1.5*4 + 1*6                  |
| 111<br>tubes_lg_reelle_11<br>1 | RONDE_50<br>x3 | 6060-T6 | 150.9<br>7 | 150.9<br>7 | 0.01 | 1 GRP1 | 0.02 | 8<br>COMB_chargemen<br>t_1.2 |
| 112<br>tubes_lg_reelle_11<br>2 | RONDE_50<br>x3 | 6060-T6 | 100.9<br>0 | 100.9<br>0 | 0.00 | 1 GRP1 | 0.00 | 1.5*4 + 1*6                  |
| 113<br>tubes_lg_reelle_11<br>3 | RONDE_50<br>x3 | 6060-T6 | 150.9<br>7 | 150.9<br>7 | 0.01 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 114<br>tubes_lg_reelle_11<br>4 | RONDE_50<br>x3 | 6060-T6 | 149.0<br>2 | 149.0<br>2 | 0.01 | 1 GRP1 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 115<br>tubes_lg_reelle_11<br>5 | RONDE_50<br>x3 | 6060-T6 | 100.9<br>0 | 100.9<br>0 | 0.00 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 116<br>tubes_lg_reelle_11<br>6 | RONDE_50<br>x2 | 6060-T6 | 147.7<br>4 | 147.7<br>4 | 0.01 | 1 GRP1 | 0.00 | 1.5*4 + 1*6                  |

|                                |                |         |            |            |      |        |      |                              |
|--------------------------------|----------------|---------|------------|------------|------|--------|------|------------------------------|
| 117<br>tubes_lg_reelle_11<br>7 | RONDE_50<br>x2 | 6060-T6 | 115.4<br>1 | 115.4<br>1 | 0.02 | 1 GRP1 | 0.00 | 1.5*4 + 1*6                  |
| 118<br>tubes_lg_reelle_11<br>8 | RONDE_50<br>x2 | 6060-T6 | 147.7<br>4 | 147.7<br>4 | 0.02 | 4 GRP4 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 119<br>tubes_lg_reelle_11<br>9 | RONDE_50<br>x2 | 6060-T6 | 115.4<br>1 | 115.4<br>1 | 0.01 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 120<br>tubes_lg_reelle_12<br>0 | RONDE_50<br>x2 | 6060-T6 | 115.4<br>1 | 115.4<br>1 | 0.01 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 121<br>tubes_lg_reelle_12<br>1 | RONDE_50<br>x2 | 6060-T6 | 147.7<br>4 | 147.7<br>4 | 0.02 | 4 GRP4 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 122<br>tubes_lg_reelle_12<br>2 | RONDE_50<br>x2 | 6060-T6 | 147.7<br>4 | 147.7<br>4 | 0.01 | 1 GRP1 | 0.00 | 1 GRP1                       |
| 123<br>tubes_lg_reelle_12<br>3 | RONDE_50<br>x2 | 6060-T6 | 115.4<br>1 | 115.4<br>1 | 0.01 | 1 GRP1 | 0.00 | 3 GRP3                       |
| 127<br>tubes_lg_reelle_12<br>7 | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.01 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 128<br>tubes_lg_reelle_12<br>8 | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.02 | 4 GRP4 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 129<br>tubes_lg_reelle_12<br>9 | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.02 | 3 GRP3 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 130<br>tubes_lg_reelle_13<br>0 | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.03 | 3 GRP3 | 0.02 | 1.5*4 + 1*6                  |
| 131<br>tubes_lg_reelle_13<br>1 | RONDE_30<br>x2 | 6060-T6 | 95.69      | 95.69      | 0.01 | 3 GRP3 | 0.00 | 1.5*4 + 1*6                  |
| 134<br>tubes_lg_reelle_13<br>4 | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.03 | 4 GRP4 | 0.03 | 1.5*4 + 1*6                  |
| 135<br>tubes_lg_reelle_13<br>5 | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.03 | 4 GRP4 | 0.01 | 1.5*4 + 1*6                  |
| 136<br>tubes_lg_reelle_13<br>6 | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.03 | 3 GRP3 | 0.00 | 1.5*4 + 1*6                  |
| 137<br>tubes_lg_reelle_13<br>7 | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.03 | 3 GRP3 | 0.02 | 1.5*4 + 1*6                  |
| 138<br>tubes_lg_reelle_13<br>8 | RONDE_30<br>x2 | 6060-T6 | 95.69      | 95.69      | 0.01 | 3 GRP3 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 139<br>tubes_lg_reelle_13<br>9 | RONDE_50<br>x3 | 6060-T6 | 100.9<br>0 | 100.9<br>0 | 0.01 | 1 GRP1 | 0.01 | 1.5*4 + 1*6                  |
| 140<br>tubes_lg_reelle_14<br>0 | RONDE_50<br>x3 | 6060-T6 | 100.9<br>0 | 100.9<br>0 | 0.01 | 1 GRP1 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 141<br>tubes_lg_reelle_14<br>1 | RONDE_50<br>x3 | 6060-T6 | 100.9<br>0 | 100.9<br>0 | 0.00 | 1 GRP1 | 0.01 | 1.5*4 + 1*6                  |
| 142<br>tubes_lg_reelle_14      | RECT_50x3      | 6060-T6 | 121.3<br>9 | 121.3<br>9 | 0.01 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen          |

|                                |                |         |            |            |      |        |      |                              |
|--------------------------------|----------------|---------|------------|------------|------|--------|------|------------------------------|
| 2                              |                |         |            |            |      |        |      | t_1.2                        |
| 143<br>tubes_lg_reelle_14<br>3 | RECT_50x3      | 6060-T6 | 121.3<br>9 | 121.3<br>9 | 0.01 | 4 GRP4 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 144<br>tubes_lg_reelle_14<br>4 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.01 | 4 GRP4 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 145<br>tubes_lg_reelle_14<br>5 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.02 | 4 GRP4 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 146<br>tubes_lg_reelle_14<br>6 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.02 | 4 GRP4 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 147<br>tubes_lg_reelle_14<br>7 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.02 | 4 GRP4 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 148<br>tubes_lg_reelle_14<br>8 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.02 | 4 GRP4 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 149<br>tubes_lg_reelle_14<br>9 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.02 | 4 GRP4 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 150<br>tubes_lg_reelle_15<br>0 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.02 | 4 GRP4 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 151<br>tubes_lg_reelle_15<br>1 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.01 | 4 GRP4 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 152<br>tubes_lg_reelle_15<br>2 | RECT_50x3      | 6060-T6 | 87.38      | 87.38      | 0.00 | 1 GRP1 | 0.00 | 1.5*4 + 1*6                  |
| 153<br>tubes_lg_reelle_15<br>3 | RECT_50x3      | 6060-T6 | 87.38      | 87.38      | 0.00 | 3 GRP3 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 157<br>tubes_lg_reelle_15<br>7 | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.01 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 158<br>tubes_lg_reelle_15<br>8 | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.02 | 3 GRP3 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 159<br>tubes_lg_reelle_15<br>9 | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.02 | 3 GRP3 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 160<br>tubes_lg_reelle_16<br>0 | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.05 | 3 GRP3 | 0.02 | 8<br>COMB_chargemen<br>t_1.2 |
| 161<br>tubes_lg_reelle_16<br>1 | RONDE_30<br>x2 | 6060-T6 | 95.69      | 95.69      | 0.01 | 3 GRP3 | 0.02 | 8<br>COMB_chargemen<br>t_1.2 |
| 164<br>tubes_lg_reelle_16<br>4 | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.02 | 1 GRP1 | 0.02 | 1.5*4 + 1*6                  |
| 165<br>tubes_lg_reelle_16<br>5 | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.02 | 3 GRP3 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 166<br>tubes_lg_reelle_16<br>6 | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.02 | 3 GRP3 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 167<br>tubes_lg_reelle_16<br>7 | RONDE_50<br>x2 | 6060-T6 | 78.89      | 78.89      | 0.04 | 3 GRP3 | 0.03 | 3 GRP3                       |
| 168                            | RONDE_30       | 6060-T6 | 95.69      | 95.69      | 0.01 | 3 GRP3 | 0.03 | 8                            |

|                                |                |         |            |            |      |        |      |                              |
|--------------------------------|----------------|---------|------------|------------|------|--------|------|------------------------------|
| tubes_lg_reelle_16<br>8        | x2             |         |            |            |      |        |      | COMB_chargemen<br>t_1.2      |
| 169<br>tubes_lg_reelle_16<br>9 | RONDE_50<br>x3 | 6060-T6 | 100.9<br>0 | 100.9<br>0 | 0.01 | 1 GRP1 | 0.01 | 1.5*4 + 1*6                  |
| 170<br>tubes_lg_reelle_17<br>0 | RONDE_50<br>x3 | 6060-T6 | 100.9<br>0 | 100.9<br>0 | 0.01 | 1 GRP1 | 0.00 | 3 GRP3                       |
| 171<br>tubes_lg_reelle_17<br>1 | RONDE_50<br>x3 | 6060-T6 | 100.9<br>0 | 100.9<br>0 | 0.05 | 3 GRP3 | 0.15 | 3 GRP3                       |
| 172<br>tubes_lg_reelle_17<br>2 | RECT_50x3      | 6060-T6 | 121.3<br>9 | 121.3<br>9 | 0.01 | 1 GRP1 | 0.00 | 1.5*4 + 1*6                  |
| 173<br>tubes_lg_reelle_17<br>3 | RECT_50x3      | 6060-T6 | 121.3<br>9 | 121.3<br>9 | 0.01 | 1 GRP1 | 0.00 | 1.5*4 + 1*6                  |
| 174<br>tubes_lg_reelle_17<br>4 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.01 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 175<br>tubes_lg_reelle_17<br>5 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.01 | 3 GRP3 | 0.00 | 1.5*4 + 1*6                  |
| 176<br>tubes_lg_reelle_17<br>6 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.02 | 3 GRP3 | 0.00 | 1.5*4 + 1*6                  |
| 177<br>tubes_lg_reelle_17<br>7 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.02 | 3 GRP3 | 0.00 | 1.5*4 + 1*6                  |
| 178<br>tubes_lg_reelle_17<br>8 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.02 | 3 GRP3 | 0.00 | 1.5*4 + 1*6                  |
| 179<br>tubes_lg_reelle_17<br>9 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.01 | 3 GRP3 | 0.00 | 1.5*4 + 1*6                  |
| 180<br>tubes_lg_reelle_18<br>0 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.01 | 3 GRP3 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 181<br>tubes_lg_reelle_18<br>1 | marc 60        | 6060-T6 | 11.78      | 68.32      | 0.01 | 3 GRP3 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |
| 182<br>tubes_lg_reelle_18<br>2 | RECT_50x3      | 6060-T6 | 87.38      | 87.38      | 0.00 | 1 GRP1 | 0.00 | 8<br>COMB_chargemen<br>t_1.2 |
| 183<br>tubes_lg_reelle_18<br>3 | RECT_50x3      | 6060-T6 | 87.38      | 87.38      | 0.00 | 1 GRP1 | 0.01 | 8<br>COMB_chargemen<br>t_1.2 |