门式刚架计算书

目 录

[1. 设计依据 3](#_Toc13890)

[2. 计算软件信息 3](#_Toc29100)

[3. 结构计算简图 3](#_Toc28913)

[4. 结构计算信息 3](#_Toc14277)

[5. 结构基本信息 5](#_Toc18897)

[6. 荷载与效应组合 7](#_Toc707)

[1. 各工况荷载表 7](#_Toc25246)

[2. 荷载效应组合表 8](#_Toc23338)

[7. 地震计算信息 11](#_Toc16538)

[1. 左地震 11](#_Toc7361)

[2. 右地震 12](#_Toc13781)

[8. 内力计算结果 12](#_Toc10546)

[1. 单工况内力 13](#_Toc32195)

[9. 节点位移 14](#_Toc29892)

[10. 构件设计结果汇总 15](#_Toc28557)

[11. 构件设计结果 16](#_Toc26112)

[12. 荷载与计算结果简图 46](#_Toc31666)

[1. 结构简图 46](#_Toc1836)

[2. 荷载简图 48](#_Toc6139)

[3. 应力比图 54](#_Toc16652)

[4. 内力图 57](#_Toc5072)

[5. 位移图 84](#_Toc20557)

[6. 挠度图 93](#_Toc24685)

[7. 计算长度系数图 97](#_Toc29558)

**1. 设计依据**

《建筑结构荷载规范》(GB 50009-2012);

《建筑抗震设计规范》(GB 50011-2010);

《钢结构设计标准》(GB 50017-2017);

《门式刚架轻型房屋钢结构技术规范》(GB 51022-2015);

《建筑结构可靠性设计统一标准》(GB 50068-2018)

《工程结构通用规范》(GB 55001-2021)

《建筑与市政工程抗震通用规范》(GB 55002-2021)

《钢结构通用规范》(GB 55006-2021)

**2. 计算软件信息**

本工程计算软件为PKPM钢结构设计软件 2021 V1.2.0版 。

计算日期为 2025年10月30日14时53分32秒。

**3. 结构计算简图**



图1-1 结构简图

**4. 结构计算信息**

结构类型: 门式刚架轻型房屋钢结构

设计规范: 按《门式刚架轻型房屋钢结构技术规范》（GB 51022-2015）计算

结构重要性系数: 1.00

节点总数: 7

柱数: 4

梁数: 2

支座约束数: 2

标准截面总数: 6

荷载分项系数：

恒载: 1.30

活载: 1.50

风载: 1.50

地震: 1.40

吊车: 1.50

重力荷载分项系数: 1.30

活荷载计算信息: 考虑活荷载不利布置

考虑结构使用年限的活荷载调整系数：1.00

风荷载计算信息: 计算风荷载

钢材: Q355

梁柱自重计算信息: 柱梁自重都计算

恒载作用下柱的轴向变形: 考虑

梁柱自重计算增大系数: 1.20

梁刚度增大系数: 1.00

钢结构净截面面积与毛截面面积比: 0.90

门式刚架梁平面内的整体稳定性: 按压弯构件验算

程序自动确定允许的长细比

钢梁(恒+活)容许挠跨比: l /240

柱顶容许水平位移/柱高: l /60

地震影响系数取值依据: 10抗规(2010版)

特征周期(s):0.35

水平地震影响系数最大值αmax:0.0400

地震作用计算: 计算水平地震作用

计算振型数：3

地震烈度：6.00

场地土类别：Ⅱ类

附加重量节点数：0

设计地震分组：第一组

周期折减系数:0.80

地震力计算方法：振型分解法

结构阻尼比：0.050

按GB50011-2010 地震效应增大系数:1.050

防火设计计算信息：考虑防火设计

建筑耐火等级：二级

**5. 结构基本信息**

**节点坐标**

| 节点号 | X | Y | 节点号 | X | Y |
| --- | --- | --- | --- | --- | --- |
| 1 | -0.20 | 7.10 | 2 | 18.20 | 7.10 |
| 3 | 9.00 | 8.00 | 4 | -0.50 | 8.60 |
| 5 | 18.50 | 8.60 | 6 | -0.20 | 0.00 |
| 7 | 18.20 | 0.00 |  |  |  |

**柱关联号**

| 柱号 | 节点Ⅰ | 节点Ⅱ | 柱号 | 节点Ⅰ | 节点Ⅱ |
| --- | --- | --- | --- | --- | --- |
| 1 | 6 | 1 | 2 | 7 | 2 |
| 3 | 1 | 4 | 4 | 2 | 5 |

**梁关联号**

| 梁号 | 节点Ⅰ | 节点Ⅱ | 梁号 | 节点Ⅰ | 节点Ⅱ |
| --- | --- | --- | --- | --- | --- |
| 1 | 1 | 3 | 2 | 3 | 2 |

**柱节点偏心 (m)**

| 节点号 | 柱偏心值 | 节点号 | 柱偏心值 | 节点号 | 柱偏心值 |
| --- | --- | --- | --- | --- | --- |
| 1 | -0.300 | 2 | 0.300 | 3 | 0.000 |
| 4 | 0.000 | 5 | 0.000 | 6 | 0.000 |
| 7 | 0.000 |  |  |  |  |

**标准截面信息**

| 截面号 | 截面信息 |
| --- | --- |
| 1 | H形变截面:  (H1~H2)\*B1\*B2\*Tw\*T1\*T2=(250~500)\*200\*200\*6\*8\*8 |
| 2 | 焊接组合H形截面:  H\*B1\*B2\*Tw\*T1\*T2=200\*180\*180\*6\*8\*8 |
| 3 | 焊接组合H形截面:  H\*B1\*B2\*Tw\*T1\*T2=400\*250\*250\*6\*12\*12 |
| 4 | 焊接组合H形截面:  H\*B1\*B2\*Tw\*T1\*T2=300\*180\*180\*6\*8\*8 |
| 5 | H形变截面:  (H1~H2)\*B1\*B2\*Tw\*T1\*T2=(600~400)\*220\*220\*6\*10\*10 |
| 6 | H形变截面:  (H1~H2)\*B1\*B2\*Tw\*T1\*T2=(400~600)\*220\*220\*6\*10\*10 |

**柱布置截面号,约束信息,截面布置角度**

| 柱号 | 标准截面号 | 约束信息 | 截面布置角度 |
| --- | --- | --- | --- |
| 1 | 3 | 两端刚接 | 0 |
| 2 | 3 | 两端刚接 | 0 |
| 3 | 2 | 两端刚接 | 0 |
| 4 | 2 | 两端刚接 | 0 |

**梁布置截面号,约束信息**

| 梁号 | 标准截面号 | 约束信息 |
| --- | --- | --- |
| 1 | 5 | 两端刚接 |
| 2 | 6 | 两端刚接 |

**截面特性**

| 截面号 | Xc (mm) | Yc (mm) | Ix (cm4) | Iy (cm4) | A (cm2) |
| --- | --- | --- | --- | --- | --- |
| 1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 90.0 | 100.0 | 2967.2 | 777.9 | 39.8 |
| 3 | 125.0 | 200.0 | 25246.7 | 3125.7 | 82.6 |
| 4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | 110.0 | 250.0 | 31944.3 | 1775.5 | 72.8 |
| 6 | 110.0 | 250.0 | 31944.3 | 1775.5 | 72.8 |

| 截面号 | ix (cm) | iy (cm) | W1x (cm3) | W2x (cm3) | W1y (cm3) | W2y (cm3) |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2 | 8.6 | 4.4 | 296.7 | 296.7 | 86.4 | 86.4 |
| 3 | 17.5 | 6.2 | 1262.3 | 1262.3 | 250.1 | 250.1 |
| 4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 5 | 20.9 | 4.9 | 1277.8 | 1277.8 | 161.4 | 161.4 |
| 6 | 20.9 | 4.9 | 1277.8 | 1277.8 | 161.4 | 161.4 |

**防火材料信息**

| 序号 | 名称 | 热传导系数(W/(m\*℃)) | 密度(kg/m^3) | 比热(J/(kg\*℃) | 类型 |
| --- | --- | --- | --- | --- | --- |
| 1 | 防火涂料1 | 0.100 | 680.00 | 1000.00 | 非膨胀 |
| 2 | 防火涂料2 | 0.100 | 680.00 | 1000.00 | 膨胀 |

**6. 荷载与效应组合**

## **1. 各工况荷载表**

**节点荷载**

| 工况 | 节点号 | 弯矩 | 垂直力 | 水平力 |
| --- | --- | --- | --- | --- |
| -- | -- | -- | -- | -- |

**柱荷载**

| 工况 | 柱号 | 荷载类型 | 荷载值 | 荷载参数1 | 荷载参数2 |
| --- | --- | --- | --- | --- | --- |
| 左风1 | 1 | 1 | 0.96 | 0.00 | 0.00 |
| 2 | 1 | 2.00 | 0.00 | 0.00 |
| 3 | 1 | 5.41 | 0.00 | 0.00 |
| 4 | 1 | 5.41 | 0.00 | 0.00 |
| 右风1 | 1 | 1 | -2.00 | 0.00 | 0.00 |
| 2 | 1 | -0.96 | 0.00 | 0.00 |
| 3 | 1 | -5.41 | 0.00 | 0.00 |
| 4 | 1 | -5.41 | 0.00 | 0.00 |
| 左风2 | 1 | 1 | 2.45 | 0.00 | 0.00 |
| 2 | 1 | 0.50 | 0.00 | 0.00 |
| 3 | 1 | 5.41 | 0.00 | 0.00 |
| 4 | 1 | 5.41 | 0.00 | 0.00 |
| 右风2 | 1 | 1 | -0.50 | 0.00 | 0.00 |
| 2 | 1 | -2.45 | 0.00 | 0.00 |
| 3 | 1 | -5.41 | 0.00 | 0.00 |
| 4 | 1 | -5.41 | 0.00 | 0.00 |

**梁荷载**

| 工况 | 连续数 | 荷载个数 | 荷载类型 | 荷载值1 | 荷载参数1 | 荷载值2 | 荷载参数2 |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 恒荷载 | 1 | 1 | 1 | 4.05 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.05 | 0.00 | 0.00 | 0.00 |
| 活荷载 | 1 | 1 | 1 | 4.50 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | 4.50 | 0.00 | 0.00 | 0.00 |
| 左风1 | 1 | 1 | 1 | -3.62 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.29 | 0.00 | 0.00 | 0.00 |
| 右风1 | 1 | 1 | 1 | -2.29 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -3.62 | 0.00 | 0.00 | 0.00 |
| 左风2 | 1 | 1 | 1 | -2.12 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -0.79 | 0.00 | 0.00 | 0.00 |
| 右风2 | 1 | 1 | 1 | -0.79 | 0.00 | 0.00 | 0.00 |
| 1 | 1 | 1 | -2.12 | 0.00 | 0.00 | 0.00 |

## **2. 荷载效应组合表**

**(1)柱内力的组合值**

| 柱内力的组合 | |
| --- | --- |
| (1)1.3恒+1.5活1 | (2)1.3恒+1.5活2 |
| (3)1.3恒+1.5活3 | (4)1.3恒+1.5活4 |
| (5)1.0恒+1.5活1 | (6)1.0恒+1.5活2 |
| (7)1.0恒+1.5活3 | (8)1.0恒+1.5活4 |
| (9)1.3恒+1.5左风1 | (10)1.3恒+1.5右风1 |
| (11)1.3恒+1.5左风2 | (12)1.3恒+1.5右风2 |
| (13)1.0恒+1.5左风1 | (14)1.0恒+1.5右风1 |
| (15)1.0恒+1.5左风2 | (16)1.0恒+1.5右风2 |
| (17)1.3恒+1.5活1+0.9左风1 | (18)1.3恒+1.5活1+0.9右风1 |
| (19)1.3恒+1.5活1+0.9左风2 | (20)1.3恒+1.5活1+0.9右风2 |
| (21)1.3恒+1.5活2+0.9左风1 | (22)1.3恒+1.5活2+0.9右风1 |
| (23)1.3恒+1.5活2+0.9左风2 | (24)1.3恒+1.5活2+0.9右风2 |
| (25)1.3恒+1.5活3+0.9左风1 | (26)1.3恒+1.5活3+0.9右风1 |
| (27)1.3恒+1.5活3+0.9左风2 | (28)1.3恒+1.5活3+0.9右风2 |
| (29)1.3恒+1.5活4+0.9左风1 | (30)1.3恒+1.5活4+0.9右风1 |
| (31)1.3恒+1.5活4+0.9左风2 | (32)1.3恒+1.5活4+0.9右风2 |
| (33)1.0恒+1.5活1+0.9左风1 | (34)1.0恒+1.5活1+0.9右风1 |
| (35)1.0恒+1.5活1+0.9左风2 | (36)1.0恒+1.5活1+0.9右风2 |
| (37)1.0恒+1.5活2+0.9左风1 | (38)1.0恒+1.5活2+0.9右风1 |
| (39)1.0恒+1.5活2+0.9左风2 | (40)1.0恒+1.5活2+0.9右风2 |
| (41)1.0恒+1.5活3+0.9左风1 | (42)1.0恒+1.5活3+0.9右风1 |
| (43)1.0恒+1.5活3+0.9左风2 | (44)1.0恒+1.5活3+0.9右风2 |
| (45)1.0恒+1.5活4+0.9左风1 | (46)1.0恒+1.5活4+0.9右风1 |
| (47)1.0恒+1.5活4+0.9左风2 | (48)1.0恒+1.5活4+0.9右风2 |
| (49)1.3恒+1.05活1+1.5左风1 | (50)1.3恒+1.05活1+1.5右风1 |
| (51)1.3恒+1.05活1+1.5左风2 | (52)1.3恒+1.05活1+1.5右风2 |
| (53)1.3恒+1.05活2+1.5左风1 | (54)1.3恒+1.05活2+1.5右风1 |
| (55)1.3恒+1.05活2+1.5左风2 | (56)1.3恒+1.05活2+1.5右风2 |
| (57)1.3恒+1.05活3+1.5左风1 | (58)1.3恒+1.05活3+1.5右风1 |
| (59)1.3恒+1.05活3+1.5左风2 | (60)1.3恒+1.05活3+1.5右风2 |
| (61)1.3恒+1.05活4+1.5左风1 | (62)1.3恒+1.05活4+1.5右风1 |
| (63)1.3恒+1.05活4+1.5左风2 | (64)1.3恒+1.05活4+1.5右风2 |
| (65)1.0恒+1.05活1+1.5左风1 | (66)1.0恒+1.05活1+1.5右风1 |
| (67)1.0恒+1.05活1+1.5左风2 | (68)1.0恒+1.05活1+1.5右风2 |
| (69)1.0恒+1.05活2+1.5左风1 | (70)1.0恒+1.05活2+1.5右风1 |
| (71)1.0恒+1.05活2+1.5左风2 | (72)1.0恒+1.05活2+1.5右风2 |
| (73)1.0恒+1.05活3+1.5左风1 | (74)1.0恒+1.05活3+1.5右风1 |
| (75)1.0恒+1.05活3+1.5左风2 | (76)1.0恒+1.05活3+1.5右风2 |
| (77)1.0恒+1.05活4+1.5左风1 | (78)1.0恒+1.05活4+1.5右风1 |
| (79)1.0恒+1.05活4+1.5左风2 | (80)1.0恒+1.05活4+1.5右风2 |
| (81)1.3恒+0.65活1+1.4左地震 | (82)1.3恒+0.65活1+1.4右地震 |
| (83)1.3恒+0.65活2+1.4左地震 | (84)1.3恒+0.65活2+1.4右地震 |
| (85)1.3恒+0.65活3+1.4左地震 | (86)1.3恒+0.65活3+1.4右地震 |
| (87)1.3恒+0.65活4+1.4左地震 | (88)1.3恒+0.65活4+1.4右地震 |
| (89)1.0恒+0.5活1+1.4左地震 | (90)1.0恒+0.5活1+1.4右地震 |
| (91)1.0恒+0.5活2+1.4左地震 | (92)1.0恒+0.5活2+1.4右地震 |
| (93)1.0恒+0.5活3+1.4左地震 | (94)1.0恒+0.5活3+1.4右地震 |
| (95)1.0恒+0.5活4+1.4左地震 | (96)1.0恒+0.5活4+1.4右地震 |

**(2)梁内力的组合值**

| 梁内力组合 | |
| --- | --- |
| (1)1.3恒+1.5活1 | (2)1.3恒+1.5活2 |
| (3)1.3恒+1.5活3 | (4)1.3恒+1.5活4 |
| (5)1.0恒+1.5活1 | (6)1.0恒+1.5活2 |
| (7)1.0恒+1.5活3 | (8)1.0恒+1.5活4 |
| (9)1.3恒+1.5左风1 | (10)1.3恒+1.5右风1 |
| (11)1.3恒+1.5左风2 | (12)1.3恒+1.5右风2 |
| (13)1.0恒+1.5左风1 | (14)1.0恒+1.5右风1 |
| (15)1.0恒+1.5左风2 | (16)1.0恒+1.5右风2 |
| (17)1.3恒+1.5活1+0.9左风1 | (18)1.3恒+1.5活1+0.9右风1 |
| (19)1.3恒+1.5活1+0.9左风2 | (20)1.3恒+1.5活1+0.9右风2 |
| (21)1.3恒+1.5活2+0.9左风1 | (22)1.3恒+1.5活2+0.9右风1 |
| (23)1.3恒+1.5活2+0.9左风2 | (24)1.3恒+1.5活2+0.9右风2 |
| (25)1.3恒+1.5活3+0.9左风1 | (26)1.3恒+1.5活3+0.9右风1 |
| (27)1.3恒+1.5活3+0.9左风2 | (28)1.3恒+1.5活3+0.9右风2 |
| (29)1.3恒+1.5活4+0.9左风1 | (30)1.3恒+1.5活4+0.9右风1 |
| (31)1.3恒+1.5活4+0.9左风2 | (32)1.3恒+1.5活4+0.9右风2 |
| (33)1.0恒+1.5活1+0.9左风1 | (34)1.0恒+1.5活1+0.9右风1 |
| (35)1.0恒+1.5活1+0.9左风2 | (36)1.0恒+1.5活1+0.9右风2 |
| (37)1.0恒+1.5活2+0.9左风1 | (38)1.0恒+1.5活2+0.9右风1 |
| (39)1.0恒+1.5活2+0.9左风2 | (40)1.0恒+1.5活2+0.9右风2 |
| (41)1.0恒+1.5活3+0.9左风1 | (42)1.0恒+1.5活3+0.9右风1 |
| (43)1.0恒+1.5活3+0.9左风2 | (44)1.0恒+1.5活3+0.9右风2 |
| (45)1.0恒+1.5活4+0.9左风1 | (46)1.0恒+1.5活4+0.9右风1 |
| (47)1.0恒+1.5活4+0.9左风2 | (48)1.0恒+1.5活4+0.9右风2 |
| (49)1.3恒+1.05活1+1.5左风1 | (50)1.3恒+1.05活1+1.5右风1 |
| (51)1.3恒+1.05活1+1.5左风2 | (52)1.3恒+1.05活1+1.5右风2 |
| (53)1.3恒+1.05活2+1.5左风1 | (54)1.3恒+1.05活2+1.5右风1 |
| (55)1.3恒+1.05活2+1.5左风2 | (56)1.3恒+1.05活2+1.5右风2 |
| (57)1.3恒+1.05活3+1.5左风1 | (58)1.3恒+1.05活3+1.5右风1 |
| (59)1.3恒+1.05活3+1.5左风2 | (60)1.3恒+1.05活3+1.5右风2 |
| (61)1.3恒+1.05活4+1.5左风1 | (62)1.3恒+1.05活4+1.5右风1 |
| (63)1.3恒+1.05活4+1.5左风2 | (64)1.3恒+1.05活4+1.5右风2 |
| (65)1.0恒+1.05活1+1.5左风1 | (66)1.0恒+1.05活1+1.5右风1 |
| (67)1.0恒+1.05活1+1.5左风2 | (68)1.0恒+1.05活1+1.5右风2 |
| (69)1.0恒+1.05活2+1.5左风1 | (70)1.0恒+1.05活2+1.5右风1 |
| (71)1.0恒+1.05活2+1.5左风2 | (72)1.0恒+1.05活2+1.5右风2 |
| (73)1.0恒+1.05活3+1.5左风1 | (74)1.0恒+1.05活3+1.5右风1 |
| (75)1.0恒+1.05活3+1.5左风2 | (76)1.0恒+1.05活3+1.5右风2 |
| (77)1.0恒+1.05活4+1.5左风1 | (78)1.0恒+1.05活4+1.5右风1 |
| (79)1.0恒+1.05活4+1.5左风2 | (80)1.0恒+1.05活4+1.5右风2 |
| (81)1.3恒+0.65活1+1.4左地震 | (82)1.3恒+0.65活1+1.4右地震 |
| (83)1.3恒+0.65活2+1.4左地震 | (84)1.3恒+0.65活2+1.4右地震 |
| (85)1.3恒+0.65活3+1.4左地震 | (86)1.3恒+0.65活3+1.4右地震 |
| (87)1.3恒+0.65活4+1.4左地震 | (88)1.3恒+0.65活4+1.4右地震 |
| (89)1.0恒+0.5活1+1.4左地震 | (90)1.0恒+0.5活1+1.4右地震 |
| (91)1.0恒+0.5活2+1.4左地震 | (92)1.0恒+0.5活2+1.4右地震 |
| (93)1.0恒+0.5活3+1.4左地震 | (94)1.0恒+0.5活3+1.4右地震 |
| (95)1.0恒+0.5活4+1.4左地震 | (96)1.0恒+0.5活4+1.4右地震 |

**(3)柱偶然组合值**

| 柱偶然组合 | |
| --- | --- |
| (1)1.0恒+0.5活1 | (2)1.0恒+0.5活2 |
| (3)1.0恒+0.5活3 | (4)1.0恒+0.5活4 |
| (5)0.9恒+0.5活1 | (6)0.9恒+0.5活2 |
| (7)0.9恒+0.5活3 | (8)0.9恒+0.5活4 |
| (9)1.0恒+0.4左风1 | (10)1.0恒+0.4右风1 |
| (11)1.0恒+0.4左风2 | (12)1.0恒+0.4右风2 |
| (13)0.9恒+0.4左风1 | (14)0.9恒+0.4右风1 |
| (15)0.9恒+0.4左风2 | (16)0.9恒+0.4右风2 |

**(4)梁偶然组合值**

| 梁偶然组合 | |
| --- | --- |
| (1)1.0恒+0.5活1 | (2)1.0恒+0.5活2 |
| (3)1.0恒+0.5活3 | (4)1.0恒+0.5活4 |
| (5)0.9恒+0.5活1 | (6)0.9恒+0.5活2 |
| (7)0.9恒+0.5活3 | (8)0.9恒+0.5活4 |
| (9)1.0恒+0.4左风1 | (10)1.0恒+0.4右风1 |
| (11)1.0恒+0.4左风2 | (12)1.0恒+0.4右风2 |
| (13)0.9恒+0.4左风1 | (14)0.9恒+0.4右风1 |
| (15)0.9恒+0.4左风2 | (16)0.9恒+0.4右风2 |

**7. 地震计算信息**

## **1. 左地震**

**地震力计算质量集中信息**

| 质量集中节点号 | 质量重量(KN) |
| --- | --- |
| 1 | 135.253 |
| 4 | 0.287 |
| 5 | 0.287 |

水平地震标准值作用底层剪力： 4.684

底层最小地震剪力(抗震规范5.2.5条): 1.087

各质点地震力调整系数: 1.000

地震力调整后剪重比： 0.034

**周期(已乘折减系数)**

| 振型号 | 周期(s) |
| --- | --- |
| 1 | 0.413 |
| 2 | 0.014 |
| 3 | 0.013 |

## **2. 右地震**

**地震力计算质量集中信息**

| 质量集中节点号 | 质量重量(KN) |
| --- | --- |
| 2 | 135.253 |
| 4 | 0.287 |
| 5 | 0.287 |

水平地震标准值作用底层剪力： 4.684

底层最小地震剪力(抗震规范5.2.5条): 1.087

各质点地震力调整系数: 1.000

地震力调整后剪重比： 0.034

**周期(已乘折减系数)**

| 振型号 | 周期(s) |
| --- | --- |
| 1 | 0.413 |
| 2 | 0.014 |
| 3 | 0.013 |

**8. 内力计算结果**

## **1. 单工况内力**

**柱内力**

| 工况 | 单元 | I端N(kN) | I端V(kN) | I端M(kN.m) | II端N(kN) | II端V(kN) | II端M(kN.m) |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 恒荷载 | 1 | 49.9 | -25.4 | -66.9 | -44.4 | 25.4 | -113.7 |
| 2 | 49.9 | 25.4 | 66.9 | -44.4 | -25.4 | 113.7 |
| 3 | 0.6 | -0.0 | -0.0 | -0.0 | 0.0 | 0.0 |
| 4 | 0.6 | -0.0 | 0.0 | 0.0 | 0.0 | -0.0 |
| 左风1 | 1 | -34.2 | 31.3 | 97.4 | 34.2 | -24.5 | 100.9 |
| 2 | -20.1 | 4.7 | 21.9 | 20.1 | 9.5 | -39.1 |
| 3 | -0.0 | 8.1 | 6.1 | 0.0 | -0.0 | 0.0 |
| 4 | -0.0 | 8.1 | 6.1 | 0.0 | -0.0 | 0.0 |
| 右风1 | 1 | -20.1 | -4.7 | -21.9 | 20.1 | -9.5 | 39.1 |
| 2 | -34.2 | -31.3 | -97.4 | 34.2 | 24.5 | -100.9 |
| 3 | -0.0 | -8.1 | -6.1 | 0.0 | 0.0 | -0.0 |
| 4 | -0.0 | -8.1 | -6.1 | 0.0 | -0.0 | 0.0 |
| 左风2 | 1 | -20.4 | 30.2 | 86.7 | 20.4 | -12.8 | 65.9 |
| 2 | -6.3 | 5.8 | 32.6 | 6.3 | -2.2 | -4.1 |
| 3 | -0.0 | 8.1 | 6.1 | 0.0 | 0.0 | 0.0 |
| 4 | -0.0 | 8.1 | 6.1 | 0.0 | 0.0 | -0.0 |
| 右风2 | 1 | -6.3 | -5.8 | -32.6 | 6.3 | 2.2 | 4.1 |
| 2 | -20.4 | -30.2 | -86.7 | 20.4 | 12.8 | -65.9 |
| 3 | 0.0 | -8.1 | -6.1 | -0.0 | 0.0 | -0.0 |
| 4 | 0.0 | -8.1 | -6.1 | -0.0 | -0.0 | 0.0 |
| 左地震 | 1 | -0.8 | 2.5 | 10.7 | 0.8 | -2.5 | 6.8 |
| 2 | 0.8 | 2.5 | 10.7 | -0.8 | -2.5 | 6.8 |
| 3 | -0.0 | 0.0 | 0.0 | 0.0 | -0.0 | 0.0 |
| 4 | -0.0 | 0.0 | 0.0 | 0.0 | -0.0 | -0.0 |
| 右地震 | 1 | 0.8 | -2.5 | -10.7 | -0.8 | 2.5 | -6.8 |
| 2 | -0.8 | -2.5 | -10.7 | 0.8 | 2.5 | -6.8 |
| 3 | 0.0 | -0.0 | -0.0 | -0.0 | 0.0 | 0.0 |
| 4 | -0.0 | -0.0 | -0.0 | 0.0 | 0.0 | -0.0 |

**梁内力**

| 工况号 | 单元号 | I端N(kN) | I端V(kN) | I端M(kN.m) | II端N(kN) | II端V(kN) | II端M(kN.m) |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 恒荷载 | 1 | 29.6 | 41.1 | 113.9 | -25.3 | 2.5 | 64.6 |
| 2 | 25.3 | 2.5 | -64.6 | -29.6 | 41.1 | -113.9 |
| 左风1 | 1 | -19.7 | -32.4 | -107.0 | 19.7 | -1.0 | -38.4 |
| 2 | -19.5 | -2.8 | 38.4 | 19.5 | -18.3 | 33.1 |
| 右风1 | 1 | -19.5 | -18.3 | -33.1 | 19.5 | -2.8 | -38.4 |
| 2 | -19.7 | -1.0 | 38.4 | 19.7 | -32.4 | 107.0 |
| 左风2 | 1 | -6.6 | -19.9 | -72.0 | 6.6 | 0.3 | -21.2 |
| 2 | -6.5 | -1.6 | 21.2 | 6.5 | -5.7 | -1.9 |
| 右风2 | 1 | -6.5 | -5.7 | 1.9 | 6.5 | -1.6 | -21.2 |
| 2 | -6.6 | 0.3 | 21.2 | 6.6 | -19.9 | 72.0 |
| 左地震 | 1 | -0.9 | -0.7 | -6.8 | 0.9 | 0.7 | -0.0 |
| 2 | 0.9 | -0.7 | 0.0 | -0.9 | 0.7 | -6.8 |
| 右地震 | 1 | 0.9 | 0.7 | 6.8 | -0.9 | -0.7 | -0.0 |
| 2 | -0.9 | 0.7 | 0.0 | 0.9 | -0.7 | 6.8 |

**9. 节点位移**

**恒荷载工况下节点位移（mm）**

| 节点号 | X向位移 | Y向位移 |
| --- | --- | --- |
| 1 | -3.27 | 0.20 |
| 2 | 3.27 | 0.20 |
| 3 | 0.00 | 35.32 |
| 4 | 1.52 | 0.20 |
| 5 | -1.52 | 0.20 |

**活荷载工况下节点位移（mm）**

| 节点号 | X向位移 | Y向位移 |
| --- | --- | --- |
| 1 | -3.10 | 0.17 |
| 2 | 3.10 | 0.17 |
| 3 | -0.00 | 33.56 |
| 4 | 1.45 | 0.17 |
| 5 | -1.45 | 0.17 |

**节点侧向（水平向）位移(mm)**

| 工况 | 节点 | δx | 节点 | δx |
| --- | --- | --- | --- | --- |
| 左风1 | 1 | 13.22 | 2 | 9.33 |
| 3 | 11.28 | 4 | 12.60 |
| 5 | 14.42 | 6 | 0.00 |
| 7 | 0.00 |  |  |
| 右风1 | 1 | -9.33 | 2 | -13.22 |
| 3 | -11.28 | 4 | -14.42 |
| 5 | -12.60 | 6 | 0.00 |
| 7 | 0.00 |  |  |
| 左风2 | 1 | 12.37 | 2 | 10.18 |
| 3 | 11.28 | 4 | 12.95 |
| 5 | 14.08 | 6 | 0.00 |
| 7 | 0.00 |  |  |
| 右风2 | 1 | -10.18 | 2 | -12.37 |
| 3 | -11.28 | 4 | -14.08 |
| 5 | -12.95 | 6 | 0.00 |
| 7 | 0.00 |  |  |
| 左地震 | 1 | 2.35 | 2 | 2.35 |
| 3 | 2.35 | 4 | 2.74 |
| 5 | 2.74 | 6 | 0.00 |
| 7 | 0.00 |  |  |
| 右地震 | 1 | -2.35 | 2 | -2.35 |
| 3 | -2.35 | 4 | -2.74 |
| 5 | -2.74 | 6 | 0.00 |
| 7 | 0.00 |  |  |

**10. 构件设计结果汇总**

**钢柱验算结果**

| 柱号 | 应力比 | 剪应力比 | 平面内稳定 | 平面外稳定 | 腹板高厚比 | 翼缘宽厚比 | 平面内长细比 | 平面外长细比 | 质量(kg) | 状态 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 0.94 | 0.20 | 0.88 | 0.91 | 62.67 | 10.17 | 51.50 | 115.39 | 460.6 | 通过 |
| 2 | 0.94 | 0.20 | 0.88 | 0.91 | 62.67 | 10.17 | 51.50 | 115.39 | 460.6 | 通过 |
| 3 | 0.11 | 0.06 | 0.10 | 0.05 | 30.67 | 10.88 | 35.45 | 33.95 | 47.8 | 通过 |
| 4 | 0.11 | 0.06 | 0.10 | 0.05 | 30.67 | 10.88 | 35.45 | 33.95 | 47.8 | 通过 |

**钢梁验算结果**

| 梁号 | 应力比 | 剪应力比 | 平面内(上端)稳定 | 平面外(下端)稳定 | 腹板高厚比 | 翼缘宽厚比 | 质量(kg) | 状态 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 0.73 | 0.37 | 0.71 | 0.72 | 80.00 | 10.70 | 528.3 | 通过 |
| 2 | 0.73 | 0.37 | 0.71 | 0.72 | 80.00 | 10.70 | 528.3 | 通过 |

**11. 构件设计结果**

**1. 钢 柱 1
设计结果**

截面类型=16; 布置角度=0; 计算长度：Lx=9.01, Ly=7.10; 长细比：λx=51.5,λy=115.4

构件长度=7.10; 计算长度系数: Ux=1.27 Uy=1.00

抗震等级: 四级

截面参数: B1=250, B2=250, H=400, Tw=6, T1=12, T2=12

轴压截面分类:X轴:b类 , Y轴:c类

构件钢号：Q355

宽厚比等级:S4

验算规范: 门规GB51022-2015

构件耐火等级: 二级

是否耐火钢: 否; 采用防火材料: 防火涂料1( 1); 形状系数: 216.569763(1/m)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | -87.03 | 64.84 | -33.07 | -147.79 | -57.66 | 33.07 |
| 2 | -182.56 | 127.24 | -69.38 | -310.01 | -120.05 | 69.38 |
| 3 | -182.56 | 127.24 | -69.38 | -310.01 | -120.05 | 69.38 |
| 4 | -87.03 | 64.84 | -33.07 | -147.79 | -57.66 | 33.07 |
| 5 | -66.95 | 49.88 | -25.44 | -113.68 | -44.35 | 25.44 |
| 6 | -162.47 | 112.27 | -61.74 | -275.91 | -106.75 | 61.74 |
| 7 | -162.47 | 112.27 | -61.74 | -275.91 | -106.75 | 61.74 |
| 8 | -66.95 | 49.88 | -25.44 | -113.68 | -44.35 | 25.44 |
| 9 | 59.07 | 13.53 | 13.91 | 3.55 | -6.34 | -3.73 |
| 10 | -119.87 | 34.67 | -40.06 | -89.08 | -27.49 | 18.80 |
| 11 | 43.01 | 34.19 | 12.22 | -48.96 | -27.00 | 13.90 |
| 12 | -135.93 | 55.33 | -41.74 | -141.59 | -48.15 | 36.43 |
| 13 | 79.15 | -1.43 | 21.54 | 37.65 | 6.96 | -11.36 |
| 14 | -99.79 | 19.71 | -32.42 | -54.97 | -14.18 | 11.17 |
| 15 | 63.09 | 19.22 | 19.86 | -14.86 | -13.70 | 6.27 |
| 16 | -115.85 | 40.37 | -34.11 | -107.49 | -34.84 | 28.80 |
| 17 | 0.63 | 34.05 | -4.88 | -56.99 | -26.87 | 10.99 |
| 18 | -106.74 | 46.74 | -37.26 | -112.56 | -39.56 | 24.51 |
| 19 | -9.01 | 46.45 | -5.89 | -88.50 | -39.26 | 21.57 |
| 20 | -116.37 | 59.13 | -38.28 | -144.07 | -51.95 | 35.09 |
| 21 | -94.89 | 96.45 | -41.18 | -219.21 | -89.27 | 47.30 |
| 22 | -202.26 | 109.14 | -73.57 | -274.79 | -101.95 | 60.81 |
| 23 | -104.53 | 108.84 | -42.20 | -250.72 | -101.66 | 57.87 |
| 24 | -211.90 | 121.53 | -74.58 | -306.29 | -114.35 | 71.39 |
| 25 | -94.89 | 96.45 | -41.18 | -219.21 | -89.27 | 47.30 |
| 26 | -202.26 | 109.14 | -73.57 | -274.79 | -101.95 | 60.81 |
| 27 | -104.53 | 108.84 | -42.20 | -250.72 | -101.66 | 57.87 |
| 28 | -211.90 | 121.53 | -74.58 | -306.29 | -114.35 | 71.39 |
| 29 | 0.63 | 34.05 | -4.88 | -56.99 | -26.87 | 10.99 |
| 30 | -106.74 | 46.74 | -37.26 | -112.56 | -39.56 | 24.51 |
| 31 | -9.01 | 46.45 | -5.89 | -88.50 | -39.26 | 21.57 |
| 32 | -116.37 | 59.13 | -38.28 | -144.07 | -51.95 | 35.09 |
| 33 | 20.71 | 19.09 | 2.75 | -22.88 | -13.56 | 3.36 |
| 34 | -86.65 | 31.78 | -29.63 | -78.46 | -26.25 | 16.88 |
| 35 | 11.08 | 31.48 | 1.74 | -54.39 | -25.96 | 13.94 |
| 36 | -96.29 | 44.17 | -30.64 | -109.97 | -38.64 | 27.46 |
| 37 | -74.81 | 81.49 | -33.55 | -185.10 | -75.96 | 39.66 |
| 38 | -182.17 | 94.17 | -65.93 | -240.68 | -88.65 | 53.18 |
| 39 | -84.45 | 93.88 | -34.56 | -216.61 | -88.35 | 50.24 |
| 40 | -191.81 | 106.57 | -66.95 | -272.19 | -101.04 | 63.76 |
| 41 | -74.81 | 81.49 | -33.55 | -185.10 | -75.96 | 39.66 |
| 42 | -182.17 | 94.17 | -65.93 | -240.68 | -88.65 | 53.18 |
| 43 | -84.45 | 93.88 | -34.56 | -216.61 | -88.35 | 50.24 |
| 44 | -191.81 | 106.57 | -66.95 | -272.19 | -101.04 | 63.76 |
| 45 | 20.71 | 19.09 | 2.75 | -22.88 | -13.56 | 3.36 |
| 46 | -86.65 | 31.78 | -29.63 | -78.46 | -26.25 | 16.88 |
| 47 | 11.08 | 31.48 | 1.74 | -54.39 | -25.96 | 13.94 |
| 48 | -96.29 | 44.17 | -30.64 | -109.97 | -38.64 | 27.46 |
| 49 | 59.07 | 13.53 | 13.91 | 3.55 | -6.34 | -3.73 |
| 50 | -119.87 | 34.67 | -40.06 | -89.08 | -27.49 | 18.80 |
| 51 | 43.01 | 34.19 | 12.22 | -48.96 | -27.00 | 13.90 |
| 52 | -135.93 | 55.33 | -41.74 | -141.59 | -48.15 | 36.43 |
| 53 | -7.80 | 57.21 | -11.50 | -110.01 | -50.02 | 21.68 |
| 54 | -186.74 | 78.35 | -65.47 | -202.64 | -71.17 | 44.21 |
| 55 | -23.86 | 77.86 | -13.19 | -162.52 | -70.68 | 39.31 |
| 56 | -202.80 | 99.01 | -67.16 | -255.15 | -91.82 | 61.84 |
| 57 | -7.80 | 57.21 | -11.50 | -110.01 | -50.02 | 21.68 |
| 58 | -186.74 | 78.35 | -65.47 | -202.64 | -71.17 | 44.21 |
| 59 | -23.86 | 77.86 | -13.19 | -162.52 | -70.68 | 39.31 |
| 60 | -202.80 | 99.01 | -67.16 | -255.15 | -91.82 | 61.84 |
| 61 | 59.07 | 13.53 | 13.91 | 3.55 | -6.34 | -3.73 |
| 62 | -119.87 | 34.67 | -40.06 | -89.08 | -27.49 | 18.80 |
| 63 | 43.01 | 34.19 | 12.22 | -48.96 | -27.00 | 13.90 |
| 64 | -135.93 | 55.33 | -41.74 | -141.59 | -48.15 | 36.43 |
| 65 | 79.15 | -1.43 | 21.54 | 37.65 | 6.96 | -11.36 |
| 66 | -99.79 | 19.71 | -32.42 | -54.97 | -14.18 | 11.17 |
| 67 | 63.09 | 19.22 | 19.86 | -14.86 | -13.70 | 6.27 |
| 68 | -115.85 | 40.37 | -34.11 | -107.49 | -34.84 | 28.80 |
| 69 | 12.29 | 42.24 | -3.87 | -75.90 | -36.72 | 14.05 |
| 70 | -166.65 | 63.39 | -57.84 | -168.53 | -57.86 | 36.58 |
| 71 | -3.78 | 62.90 | -5.55 | -128.42 | -57.37 | 31.68 |
| 72 | -182.71 | 84.04 | -59.52 | -221.04 | -78.52 | 54.21 |
| 73 | 12.29 | 42.24 | -3.87 | -75.90 | -36.72 | 14.05 |
| 74 | -166.65 | 63.39 | -57.84 | -168.53 | -57.86 | 36.58 |
| 75 | -3.78 | 62.90 | -5.55 | -128.42 | -57.37 | 31.68 |
| 76 | -182.71 | 84.04 | -59.52 | -221.04 | -78.52 | 54.21 |
| 77 | 79.15 | -1.43 | 21.54 | 37.65 | 6.96 | -11.36 |
| 78 | -99.79 | 19.71 | -32.42 | -54.97 | -14.18 | 11.17 |
| 79 | 63.09 | 19.22 | 19.86 | -14.86 | -13.70 | 6.27 |
| 80 | -115.85 | 40.37 | -34.11 | -107.49 | -34.84 | 28.80 |
| 81 | -72.11 | 63.69 | -29.63 | -138.27 | -56.51 | 29.63 |
| 82 | -101.96 | 65.99 | -36.52 | -157.31 | -58.81 | 36.52 |
| 83 | -113.50 | 90.73 | -45.36 | -208.57 | -83.55 | 45.36 |
| 84 | -143.35 | 93.03 | -52.25 | -227.61 | -85.84 | 52.25 |
| 85 | -113.50 | 90.73 | -45.36 | -208.57 | -83.55 | 45.36 |
| 86 | -143.35 | 93.03 | -52.25 | -227.61 | -85.84 | 52.25 |
| 87 | -72.11 | 63.69 | -29.63 | -138.27 | -56.51 | 29.63 |
| 88 | -101.96 | 65.99 | -36.52 | -157.31 | -58.81 | 36.52 |
| 89 | -52.02 | 48.73 | -22.00 | -104.16 | -43.20 | 22.00 |
| 90 | -81.87 | 51.03 | -28.88 | -123.21 | -45.50 | 28.88 |
| 91 | -83.86 | 69.53 | -34.10 | -158.24 | -64.00 | 34.10 |
| 92 | -113.71 | 71.83 | -40.98 | -177.28 | -66.30 | 40.98 |
| 93 | -83.86 | 69.53 | -34.10 | -158.24 | -64.00 | 34.10 |
| 94 | -113.71 | 71.83 | -40.98 | -177.28 | -66.30 | 40.98 |
| 95 | -52.02 | 48.73 | -22.00 | -104.16 | -43.20 | 22.00 |
| 96 | -81.87 | 51.03 | -28.88 | -123.21 | -45.50 | 28.88 |

强度计算控制组合号: 2, M=-182.56, N=127.24, M=-310.01, N=-120.05

强度计算应力比 =0.939

抗剪强度计算控制组合号: 24, V=-74.58

抗剪强度计算应力比 =0.205

平面内稳定计算最大应力对应组合号: 2, M=-182.56, N=127.24, M=-310.01, N=-120.05

平面内稳定计算最大应力 (N/mm\*mm) =268.75

平面内稳定计算最大应力比 =0.881

临界弯矩Mcr(kN\*m) =829.68

平面外稳定计算最大应力比 =0.907

门规GB51022-2015腹板容许高厚比 [H0/TW] =250.00

翼缘容许宽厚比 [B/T] =12.20

强度计算应力比 =0.939 < 1.0

抗剪强度计算应力比 =0.205 < 1.0

平面内稳定计算最大应力 < f=305.00

平面外稳定计算最大应力比 < 1.0

腹板高厚比 H0/TW=62.67 < [H0/TW]=250.00

翼缘宽厚比 B/T =10.17 < [B/T]=12.20

压杆,平面内长细比 λ=51. ≤ [λ]=180

压杆,平面外长细比 λ=115. ≤ [λ]=180

钢构件防火设计结果:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 偶然组合 | | | | | | |
| \ | 柱 下 端 | | | 柱 上 端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | -66.95 | 49.88 | -25.44 | -113.68 | -44.35 | 25.44 |
| 2 | -98.79 | 70.68 | -37.54 | -167.76 | -65.15 | 37.54 |
| 3 | -98.79 | 70.68 | -37.54 | -167.76 | -65.15 | 37.54 |
| 4 | -66.95 | 49.88 | -25.44 | -113.68 | -44.35 | 25.44 |
| 5 | -60.25 | 44.89 | -22.90 | -102.32 | -39.92 | 22.90 |
| 6 | -92.09 | 65.69 | -35.00 | -156.39 | -60.71 | 35.00 |
| 7 | -92.09 | 65.69 | -35.00 | -156.39 | -60.71 | 35.00 |
| 8 | -60.25 | 44.89 | -22.90 | -102.32 | -39.92 | 22.90 |
| 9 | -27.99 | 36.19 | -12.91 | -73.33 | -30.67 | 15.63 |
| 10 | -75.70 | 41.83 | -27.30 | -98.03 | -36.31 | 21.64 |
| 11 | -32.27 | 41.70 | -13.36 | -87.33 | -36.18 | 20.33 |
| 12 | -79.99 | 47.34 | -27.75 | -112.03 | -41.81 | 26.34 |
| 13 | -21.29 | 31.21 | -10.37 | -61.96 | -26.23 | 13.08 |
| 14 | -69.01 | 36.85 | -24.76 | -86.66 | -31.87 | 19.09 |
| 15 | -25.58 | 36.72 | -10.82 | -75.96 | -31.74 | 17.78 |
| 16 | -73.29 | 42.35 | -25.21 | -100.66 | -37.38 | 23.79 |

防火设计控制的偶然组合号: 2, M=-98.79, N=70.68, M=-167.76, N=-65.15

强度计算荷载比 =0.50

平面内稳定计算荷载比 =0.47

平面外稳定计算荷载比 =0.39

无防护下钢构件最大升温(Ts): 1081.68℃ ,按临界温度法求得临界温度(Td): 582.20℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.4601(m^2\*℃/w) ,计算所需保护层厚度(di) =46.01(mm)

构件重量 (Kg)=460.56

**2. 钢 柱 2
设计结果**

截面类型=16; 布置角度=0; 计算长度：Lx=9.01, Ly=7.10; 长细比：λx=51.5,λy=115.4

构件长度=7.10; 计算长度系数: Ux=1.27 Uy=1.00

抗震等级: 四级

截面参数: B1=250, B2=250, H=400, Tw=6, T1=12, T2=12

轴压截面分类:X轴:b类 , Y轴:c类

构件钢号：Q355

宽厚比等级:S4

验算规范: 门规GB51022-2015

构件耐火等级: 二级

是否耐火钢: 否; 采用防火材料: 防火涂料1( 1); 形状系数: 216.569763(1/m)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 182.56 | 127.24 | 69.38 | 310.01 | -120.05 | -69.38 |
| 2 | 87.03 | 64.84 | 33.07 | 147.79 | -57.66 | -33.07 |
| 3 | 182.56 | 127.24 | 69.38 | 310.01 | -120.05 | -69.38 |
| 4 | 87.03 | 64.84 | 33.07 | 147.79 | -57.66 | -33.07 |
| 5 | 162.47 | 112.27 | 61.74 | 275.91 | -106.75 | -61.74 |
| 6 | 66.95 | 49.88 | 25.44 | 113.68 | -44.35 | -25.44 |
| 7 | 162.47 | 112.27 | 61.74 | 275.91 | -106.75 | -61.74 |
| 8 | 66.95 | 49.88 | 25.44 | 113.68 | -44.35 | -25.44 |
| 9 | 119.87 | 34.67 | 40.06 | 89.08 | -27.49 | -18.80 |
| 10 | -59.07 | 13.53 | -13.91 | -3.55 | -6.34 | 3.73 |
| 11 | 135.93 | 55.33 | 41.74 | 141.59 | -48.15 | -36.43 |
| 12 | -43.01 | 34.19 | -12.22 | 48.96 | -27.00 | -13.90 |
| 13 | 99.79 | 19.71 | 32.42 | 54.97 | -14.18 | -11.17 |
| 14 | -79.15 | -1.43 | -21.54 | -37.65 | 6.96 | 11.36 |
| 15 | 115.85 | 40.37 | 34.11 | 107.49 | -34.84 | -28.80 |
| 16 | -63.09 | 19.22 | -19.86 | 14.86 | -13.70 | -6.27 |
| 17 | 202.26 | 109.14 | 73.57 | 274.79 | -101.95 | -60.81 |
| 18 | 94.89 | 96.45 | 41.18 | 219.21 | -89.27 | -47.30 |
| 19 | 211.90 | 121.53 | 74.58 | 306.29 | -114.35 | -71.39 |
| 20 | 104.53 | 108.84 | 42.20 | 250.72 | -101.66 | -57.87 |
| 21 | 106.74 | 46.74 | 37.26 | 112.56 | -39.56 | -24.51 |
| 22 | -0.63 | 34.05 | 4.88 | 56.99 | -26.87 | -10.99 |
| 23 | 116.37 | 59.13 | 38.28 | 144.07 | -51.95 | -35.09 |
| 24 | 9.01 | 46.45 | 5.89 | 88.50 | -39.26 | -21.57 |
| 25 | 202.26 | 109.14 | 73.57 | 274.79 | -101.95 | -60.81 |
| 26 | 94.89 | 96.45 | 41.18 | 219.21 | -89.27 | -47.30 |
| 27 | 211.90 | 121.53 | 74.58 | 306.29 | -114.35 | -71.39 |
| 28 | 104.53 | 108.84 | 42.20 | 250.72 | -101.66 | -57.87 |
| 29 | 106.74 | 46.74 | 37.26 | 112.56 | -39.56 | -24.51 |
| 30 | -0.63 | 34.05 | 4.88 | 56.99 | -26.87 | -10.99 |
| 31 | 116.37 | 59.13 | 38.28 | 144.07 | -51.95 | -35.09 |
| 32 | 9.01 | 46.45 | 5.89 | 88.50 | -39.26 | -21.57 |
| 33 | 182.17 | 94.17 | 65.93 | 240.68 | -88.65 | -53.18 |
| 34 | 74.81 | 81.49 | 33.55 | 185.10 | -75.96 | -39.66 |
| 35 | 191.81 | 106.57 | 66.95 | 272.19 | -101.04 | -63.76 |
| 36 | 84.45 | 93.88 | 34.56 | 216.61 | -88.35 | -50.24 |
| 37 | 86.65 | 31.78 | 29.63 | 78.46 | -26.25 | -16.88 |
| 38 | -20.71 | 19.09 | -2.75 | 22.88 | -13.56 | -3.36 |
| 39 | 96.29 | 44.17 | 30.64 | 109.97 | -38.64 | -27.46 |
| 40 | -11.08 | 31.48 | -1.74 | 54.39 | -25.96 | -13.94 |
| 41 | 182.17 | 94.17 | 65.93 | 240.68 | -88.65 | -53.18 |
| 42 | 74.81 | 81.49 | 33.55 | 185.10 | -75.96 | -39.66 |
| 43 | 191.81 | 106.57 | 66.95 | 272.19 | -101.04 | -63.76 |
| 44 | 84.45 | 93.88 | 34.56 | 216.61 | -88.35 | -50.24 |
| 45 | 86.65 | 31.78 | 29.63 | 78.46 | -26.25 | -16.88 |
| 46 | -20.71 | 19.09 | -2.75 | 22.88 | -13.56 | -3.36 |
| 47 | 96.29 | 44.17 | 30.64 | 109.97 | -38.64 | -27.46 |
| 48 | -11.08 | 31.48 | -1.74 | 54.39 | -25.96 | -13.94 |
| 49 | 186.74 | 78.35 | 65.47 | 202.64 | -71.17 | -44.21 |
| 50 | 7.80 | 57.21 | 11.50 | 110.01 | -50.02 | -21.68 |
| 51 | 202.80 | 99.01 | 67.16 | 255.15 | -91.82 | -61.84 |
| 52 | 23.86 | 77.86 | 13.19 | 162.52 | -70.68 | -39.31 |
| 53 | 119.87 | 34.67 | 40.06 | 89.08 | -27.49 | -18.80 |
| 54 | -59.07 | 13.53 | -13.91 | -3.55 | -6.34 | 3.73 |
| 55 | 135.93 | 55.33 | 41.74 | 141.59 | -48.15 | -36.43 |
| 56 | -43.01 | 34.19 | -12.22 | 48.96 | -27.00 | -13.90 |
| 57 | 186.74 | 78.35 | 65.47 | 202.64 | -71.17 | -44.21 |
| 58 | 7.80 | 57.21 | 11.50 | 110.01 | -50.02 | -21.68 |
| 59 | 202.80 | 99.01 | 67.16 | 255.15 | -91.82 | -61.84 |
| 60 | 23.86 | 77.86 | 13.19 | 162.52 | -70.68 | -39.31 |
| 61 | 119.87 | 34.67 | 40.06 | 89.08 | -27.49 | -18.80 |
| 62 | -59.07 | 13.53 | -13.91 | -3.55 | -6.34 | 3.73 |
| 63 | 135.93 | 55.33 | 41.74 | 141.59 | -48.15 | -36.43 |
| 64 | -43.01 | 34.19 | -12.22 | 48.96 | -27.00 | -13.90 |
| 65 | 166.65 | 63.39 | 57.84 | 168.53 | -57.86 | -36.58 |
| 66 | -12.29 | 42.24 | 3.87 | 75.90 | -36.72 | -14.05 |
| 67 | 182.71 | 84.04 | 59.52 | 221.04 | -78.52 | -54.21 |
| 68 | 3.78 | 62.90 | 5.55 | 128.42 | -57.37 | -31.68 |
| 69 | 99.79 | 19.71 | 32.42 | 54.97 | -14.18 | -11.17 |
| 70 | -79.15 | -1.43 | -21.54 | -37.65 | 6.96 | 11.36 |
| 71 | 115.85 | 40.37 | 34.11 | 107.49 | -34.84 | -28.80 |
| 72 | -63.09 | 19.22 | -19.86 | 14.86 | -13.70 | -6.27 |
| 73 | 166.65 | 63.39 | 57.84 | 168.53 | -57.86 | -36.58 |
| 74 | -12.29 | 42.24 | 3.87 | 75.90 | -36.72 | -14.05 |
| 75 | 182.71 | 84.04 | 59.52 | 221.04 | -78.52 | -54.21 |
| 76 | 3.78 | 62.90 | 5.55 | 128.42 | -57.37 | -31.68 |
| 77 | 99.79 | 19.71 | 32.42 | 54.97 | -14.18 | -11.17 |
| 78 | -79.15 | -1.43 | -21.54 | -37.65 | 6.96 | 11.36 |
| 79 | 115.85 | 40.37 | 34.11 | 107.49 | -34.84 | -28.80 |
| 80 | -63.09 | 19.22 | -19.86 | 14.86 | -13.70 | -6.27 |
| 81 | 143.35 | 93.03 | 52.25 | 227.61 | -85.84 | -52.25 |
| 82 | 113.50 | 90.73 | 45.36 | 208.57 | -83.55 | -45.36 |
| 83 | 101.96 | 65.99 | 36.52 | 157.31 | -58.81 | -36.52 |
| 84 | 72.11 | 63.69 | 29.63 | 138.27 | -56.51 | -29.63 |
| 85 | 143.35 | 93.03 | 52.25 | 227.61 | -85.84 | -52.25 |
| 86 | 113.50 | 90.73 | 45.36 | 208.57 | -83.55 | -45.36 |
| 87 | 101.96 | 65.99 | 36.52 | 157.31 | -58.81 | -36.52 |
| 88 | 72.11 | 63.69 | 29.63 | 138.27 | -56.51 | -29.63 |
| 89 | 113.71 | 71.83 | 40.98 | 177.28 | -66.30 | -40.98 |
| 90 | 83.86 | 69.53 | 34.10 | 158.24 | -64.00 | -34.10 |
| 91 | 81.87 | 51.03 | 28.88 | 123.21 | -45.50 | -28.88 |
| 92 | 52.02 | 48.73 | 22.00 | 104.16 | -43.20 | -22.00 |
| 93 | 113.71 | 71.83 | 40.98 | 177.28 | -66.30 | -40.98 |
| 94 | 83.86 | 69.53 | 34.10 | 158.24 | -64.00 | -34.10 |
| 95 | 81.87 | 51.03 | 28.88 | 123.21 | -45.50 | -28.88 |
| 96 | 52.02 | 48.73 | 22.00 | 104.16 | -43.20 | -22.00 |

强度计算控制组合号: 1, M=182.56, N=127.24, M=310.01, N=-120.05

强度计算应力比 =0.939

抗剪强度计算控制组合号: 19, V=74.58

抗剪强度计算应力比 =0.205

平面内稳定计算最大应力对应组合号: 1, M=182.56, N=127.24, M=310.01, N=-120.05

平面内稳定计算最大应力 (N/mm\*mm) =268.75

平面内稳定计算最大应力比 =0.881

临界弯矩Mcr(kN\*m) =829.68

平面外稳定计算最大应力比 =0.907

门规GB51022-2015腹板容许高厚比 [H0/TW] =250.00

翼缘容许宽厚比 [B/T] =12.20

强度计算应力比 =0.939 < 1.0

抗剪强度计算应力比 =0.205 < 1.0

平面内稳定计算最大应力 < f=305.00

平面外稳定计算最大应力比 < 1.0

腹板高厚比 H0/TW=62.67 < [H0/TW]=250.00

翼缘宽厚比 B/T =10.17 < [B/T]=12.20

压杆,平面内长细比 λ=51. ≤ [λ]=180

压杆,平面外长细比 λ=115. ≤ [λ]=180

钢构件防火设计结果:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 偶然组合 | | | | | | |
| \ | 柱 下 端 | | | 柱 上 端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 98.79 | 70.68 | 37.54 | 167.76 | -65.15 | -37.54 |
| 2 | 66.95 | 49.88 | 25.44 | 113.68 | -44.35 | -25.44 |
| 3 | 98.79 | 70.68 | 37.54 | 167.76 | -65.15 | -37.54 |
| 4 | 66.95 | 49.88 | 25.44 | 113.68 | -44.35 | -25.44 |
| 5 | 92.09 | 65.69 | 35.00 | 156.39 | -60.71 | -35.00 |
| 6 | 60.25 | 44.89 | 22.90 | 102.32 | -39.92 | -22.90 |
| 7 | 92.09 | 65.69 | 35.00 | 156.39 | -60.71 | -35.00 |
| 8 | 60.25 | 44.89 | 22.90 | 102.32 | -39.92 | -22.90 |
| 9 | 75.70 | 41.83 | 27.30 | 98.03 | -36.31 | -21.64 |
| 10 | 27.99 | 36.19 | 12.91 | 73.33 | -30.67 | -15.63 |
| 11 | 79.99 | 47.34 | 27.75 | 112.03 | -41.81 | -26.34 |
| 12 | 32.27 | 41.70 | 13.36 | 87.33 | -36.18 | -20.33 |
| 13 | 69.01 | 36.85 | 24.76 | 86.66 | -31.87 | -19.09 |
| 14 | 21.29 | 31.21 | 10.37 | 61.96 | -26.23 | -13.08 |
| 15 | 73.29 | 42.35 | 25.21 | 100.66 | -37.38 | -23.79 |
| 16 | 25.58 | 36.72 | 10.82 | 75.96 | -31.74 | -17.78 |

防火设计控制的偶然组合号: 1, M=98.79, N=70.68, M=167.76, N=-65.15

强度计算荷载比 =0.50

平面内稳定计算荷载比 =0.47

平面外稳定计算荷载比 =0.39

无防护下钢构件最大升温(Ts): 1081.68℃ ,按临界温度法求得临界温度(Td): 582.20℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.4601(m^2\*℃/w) ,计算所需保护层厚度(di) =46.01(mm)

构件重量 (Kg)=460.56

**3. 钢 柱 3
设计结果**

截面类型=16; 布置角度=0; 计算长度：Lx=3.00, Ly=1.50; 长细比：λx=35.5,λy=33.9

构件长度=1.53; 计算长度系数: Ux=1.96 Uy=0.98

抗震等级: 四级

截面参数: B1=180, B2=180, H=200, Tw=6, T1=8, T2=8

轴压截面分类:X轴:b类 , Y轴:c类

构件钢号：Q355

宽厚比等级:S4

验算规范: 门规GB51022-2015

构件耐火等级: 二级

是否耐火钢: 否; 采用防火材料: 防火涂料1( 1); 形状系数: 278.112457(1/m)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | -0.00 | 0.75 | -0.00 | 0.00 | -0.00 | 0.00 |
| 2 | -0.00 | 0.75 | -0.00 | 0.00 | -0.00 | 0.00 |
| 3 | -0.00 | 0.75 | -0.00 | 0.00 | -0.00 | 0.00 |
| 4 | -0.00 | 0.75 | -0.00 | 0.00 | -0.00 | 0.00 |
| 5 | -0.00 | 0.57 | -0.00 | 0.00 | -0.00 | 0.00 |
| 6 | -0.00 | 0.57 | -0.00 | 0.00 | -0.00 | 0.00 |
| 7 | -0.00 | 0.57 | -0.00 | 0.00 | -0.00 | 0.00 |
| 8 | -0.00 | 0.57 | -0.00 | 0.00 | -0.00 | 0.00 |
| 9 | 9.12 | 0.75 | 12.16 | 0.00 | -0.00 | -0.00 |
| 10 | -9.12 | 0.75 | -12.16 | -0.00 | -0.00 | 0.00 |
| 11 | 9.12 | 0.75 | 12.16 | 0.00 | -0.00 | 0.00 |
| 12 | -9.12 | 0.75 | -12.16 | -0.00 | -0.00 | 0.00 |
| 13 | 9.12 | 0.57 | 12.16 | 0.00 | -0.00 | -0.00 |
| 14 | -9.12 | 0.57 | -12.16 | -0.00 | -0.00 | 0.00 |
| 15 | 9.12 | 0.57 | 12.16 | 0.00 | -0.00 | 0.00 |
| 16 | -9.12 | 0.57 | -12.16 | -0.00 | -0.00 | 0.00 |
| 17 | 5.47 | 0.75 | 7.30 | 0.00 | -0.00 | -0.00 |
| 18 | -5.47 | 0.75 | -7.30 | -0.00 | -0.00 | 0.00 |
| 19 | 5.47 | 0.75 | 7.30 | 0.00 | -0.00 | 0.00 |
| 20 | -5.47 | 0.75 | -7.30 | -0.00 | -0.00 | 0.00 |
| 21 | 5.47 | 0.75 | 7.30 | 0.00 | -0.00 | -0.00 |
| 22 | -5.47 | 0.75 | -7.30 | -0.00 | -0.00 | 0.00 |
| 23 | 5.47 | 0.75 | 7.30 | 0.00 | -0.00 | 0.00 |
| 24 | -5.47 | 0.75 | -7.30 | -0.00 | -0.00 | 0.00 |
| 25 | 5.47 | 0.75 | 7.30 | 0.00 | -0.00 | -0.00 |
| 26 | -5.47 | 0.75 | -7.30 | -0.00 | -0.00 | 0.00 |
| 27 | 5.47 | 0.75 | 7.30 | 0.00 | -0.00 | 0.00 |
| 28 | -5.47 | 0.75 | -7.30 | -0.00 | -0.00 | 0.00 |
| 29 | 5.47 | 0.75 | 7.30 | 0.00 | -0.00 | -0.00 |
| 30 | -5.47 | 0.75 | -7.30 | -0.00 | -0.00 | 0.00 |
| 31 | 5.47 | 0.75 | 7.30 | 0.00 | -0.00 | 0.00 |
| 32 | -5.47 | 0.75 | -7.30 | -0.00 | -0.00 | 0.00 |
| 33 | 5.47 | 0.57 | 7.30 | 0.00 | -0.00 | -0.00 |
| 34 | -5.47 | 0.57 | -7.30 | -0.00 | -0.00 | 0.00 |
| 35 | 5.47 | 0.57 | 7.30 | 0.00 | -0.00 | 0.00 |
| 36 | -5.47 | 0.57 | -7.30 | -0.00 | -0.00 | 0.00 |
| 37 | 5.47 | 0.57 | 7.30 | 0.00 | -0.00 | -0.00 |
| 38 | -5.47 | 0.57 | -7.30 | -0.00 | -0.00 | 0.00 |
| 39 | 5.47 | 0.57 | 7.30 | 0.00 | -0.00 | 0.00 |
| 40 | -5.47 | 0.57 | -7.30 | -0.00 | -0.00 | 0.00 |
| 41 | 5.47 | 0.57 | 7.30 | 0.00 | -0.00 | -0.00 |
| 42 | -5.47 | 0.57 | -7.30 | -0.00 | -0.00 | 0.00 |
| 43 | 5.47 | 0.57 | 7.30 | 0.00 | -0.00 | 0.00 |
| 44 | -5.47 | 0.57 | -7.30 | -0.00 | -0.00 | 0.00 |
| 45 | 5.47 | 0.57 | 7.30 | 0.00 | -0.00 | -0.00 |
| 46 | -5.47 | 0.57 | -7.30 | -0.00 | -0.00 | 0.00 |
| 47 | 5.47 | 0.57 | 7.30 | 0.00 | -0.00 | 0.00 |
| 48 | -5.47 | 0.57 | -7.30 | -0.00 | -0.00 | 0.00 |
| 49 | 9.12 | 0.75 | 12.16 | 0.00 | -0.00 | -0.00 |
| 50 | -9.12 | 0.75 | -12.16 | -0.00 | -0.00 | 0.00 |
| 51 | 9.12 | 0.75 | 12.16 | 0.00 | -0.00 | 0.00 |
| 52 | -9.12 | 0.75 | -12.16 | -0.00 | -0.00 | 0.00 |
| 53 | 9.12 | 0.75 | 12.16 | 0.00 | -0.00 | -0.00 |
| 54 | -9.12 | 0.75 | -12.16 | -0.00 | -0.00 | 0.00 |
| 55 | 9.12 | 0.75 | 12.16 | 0.00 | -0.00 | 0.00 |
| 56 | -9.12 | 0.75 | -12.16 | -0.00 | -0.00 | 0.00 |
| 57 | 9.12 | 0.75 | 12.16 | 0.00 | -0.00 | -0.00 |
| 58 | -9.12 | 0.75 | -12.16 | -0.00 | -0.00 | 0.00 |
| 59 | 9.12 | 0.75 | 12.16 | 0.00 | -0.00 | 0.00 |
| 60 | -9.12 | 0.75 | -12.16 | -0.00 | -0.00 | 0.00 |
| 61 | 9.12 | 0.75 | 12.16 | 0.00 | -0.00 | -0.00 |
| 62 | -9.12 | 0.75 | -12.16 | -0.00 | -0.00 | 0.00 |
| 63 | 9.12 | 0.75 | 12.16 | 0.00 | -0.00 | 0.00 |
| 64 | -9.12 | 0.75 | -12.16 | -0.00 | -0.00 | 0.00 |
| 65 | 9.12 | 0.57 | 12.16 | 0.00 | -0.00 | -0.00 |
| 66 | -9.12 | 0.57 | -12.16 | -0.00 | -0.00 | 0.00 |
| 67 | 9.12 | 0.57 | 12.16 | 0.00 | -0.00 | 0.00 |
| 68 | -9.12 | 0.57 | -12.16 | -0.00 | -0.00 | 0.00 |
| 69 | 9.12 | 0.57 | 12.16 | 0.00 | -0.00 | -0.00 |
| 70 | -9.12 | 0.57 | -12.16 | -0.00 | -0.00 | 0.00 |
| 71 | 9.12 | 0.57 | 12.16 | 0.00 | -0.00 | 0.00 |
| 72 | -9.12 | 0.57 | -12.16 | -0.00 | -0.00 | 0.00 |
| 73 | 9.12 | 0.57 | 12.16 | 0.00 | -0.00 | -0.00 |
| 74 | -9.12 | 0.57 | -12.16 | -0.00 | -0.00 | 0.00 |
| 75 | 9.12 | 0.57 | 12.16 | 0.00 | -0.00 | 0.00 |
| 76 | -9.12 | 0.57 | -12.16 | -0.00 | -0.00 | 0.00 |
| 77 | 9.12 | 0.57 | 12.16 | 0.00 | -0.00 | -0.00 |
| 78 | -9.12 | 0.57 | -12.16 | -0.00 | -0.00 | 0.00 |
| 79 | 9.12 | 0.57 | 12.16 | 0.00 | -0.00 | 0.00 |
| 80 | -9.12 | 0.57 | -12.16 | -0.00 | -0.00 | 0.00 |
| 81 | 0.03 | 0.75 | 0.02 | 0.00 | -0.00 | -0.02 |
| 82 | -0.03 | 0.75 | -0.02 | 0.00 | -0.00 | 0.02 |
| 83 | 0.03 | 0.75 | 0.02 | 0.00 | -0.00 | -0.02 |
| 84 | -0.03 | 0.75 | -0.02 | 0.00 | -0.00 | 0.02 |
| 85 | 0.03 | 0.75 | 0.02 | 0.00 | -0.00 | -0.02 |
| 86 | -0.03 | 0.75 | -0.02 | 0.00 | -0.00 | 0.02 |
| 87 | 0.03 | 0.75 | 0.02 | 0.00 | -0.00 | -0.02 |
| 88 | -0.03 | 0.75 | -0.02 | 0.00 | -0.00 | 0.02 |
| 89 | 0.03 | 0.57 | 0.02 | 0.00 | -0.00 | -0.02 |
| 90 | -0.03 | 0.57 | -0.02 | 0.00 | -0.00 | 0.02 |
| 91 | 0.03 | 0.57 | 0.02 | 0.00 | -0.00 | -0.02 |
| 92 | -0.03 | 0.57 | -0.02 | 0.00 | -0.00 | 0.02 |
| 93 | 0.03 | 0.57 | 0.02 | 0.00 | -0.00 | -0.02 |
| 94 | -0.03 | 0.57 | -0.02 | 0.00 | -0.00 | 0.02 |
| 95 | 0.03 | 0.57 | 0.02 | 0.00 | -0.00 | -0.02 |
| 96 | -0.03 | 0.57 | -0.02 | 0.00 | -0.00 | 0.02 |

强度计算控制组合号: 54, M=-9.12, N=0.75, M=-0.00, N=-0.00

强度计算应力比 =0.112

抗剪强度计算控制组合号: 54, V=-12.16

抗剪强度计算应力比 =0.063

平面内稳定计算最大应力对应组合号: 54, M=-9.12, N=0.75, M=-0.00, N=-0.00

平面内稳定计算最大应力 (N/mm\*mm) =30.96

平面内稳定计算最大应力比 =0.101

临界弯矩Mcr(kN\*m) =1309.58

平面外稳定计算最大应力比 =0.048

门规GB51022-2015腹板容许高厚比 [H0/TW] =250.00

翼缘容许宽厚比 [B/T] =12.20

强度计算应力比 =0.112 < 1.0

抗剪强度计算应力比 =0.063 < 1.0

平面内稳定计算最大应力 < f=305.00

平面外稳定计算最大应力比 < 1.0

腹板高厚比 H0/TW=30.67 < [H0/TW]=250.00

翼缘宽厚比 B/T =10.88 < [B/T]=12.20

压杆,平面内长细比 λ=35. ≤ [λ]=180

压杆,平面外长细比 λ=34. ≤ [λ]=180

钢构件防火设计结果:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 偶然组合 | | | | | | |
| \ | 柱 下 端 | | | 柱 上 端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | -0.00 | 0.57 | -0.00 | 0.00 | -0.00 | 0.00 |
| 2 | -0.00 | 0.57 | -0.00 | 0.00 | -0.00 | 0.00 |
| 3 | -0.00 | 0.57 | -0.00 | 0.00 | -0.00 | 0.00 |
| 4 | -0.00 | 0.57 | -0.00 | 0.00 | -0.00 | 0.00 |
| 5 | -0.00 | 0.52 | -0.00 | 0.00 | -0.00 | 0.00 |
| 6 | -0.00 | 0.52 | -0.00 | 0.00 | -0.00 | 0.00 |
| 7 | -0.00 | 0.52 | -0.00 | 0.00 | -0.00 | 0.00 |
| 8 | -0.00 | 0.52 | -0.00 | 0.00 | -0.00 | 0.00 |
| 9 | 2.43 | 0.57 | 3.24 | 0.00 | -0.00 | -0.00 |
| 10 | -2.43 | 0.57 | -3.24 | -0.00 | -0.00 | 0.00 |
| 11 | 2.43 | 0.57 | 3.24 | 0.00 | -0.00 | 0.00 |
| 12 | -2.43 | 0.57 | -3.24 | -0.00 | -0.00 | 0.00 |
| 13 | 2.43 | 0.52 | 3.24 | 0.00 | -0.00 | -0.00 |
| 14 | -2.43 | 0.52 | -3.24 | -0.00 | -0.00 | 0.00 |
| 15 | 2.43 | 0.52 | 3.24 | 0.00 | -0.00 | 0.00 |
| 16 | -2.43 | 0.52 | -3.24 | -0.00 | -0.00 | 0.00 |

防火设计控制的偶然组合号: 10, M=-2.43, N=0.57, M=-0.00, N=-0.00

强度计算荷载比 =0.03

平面内稳定计算荷载比 =0.03

平面外稳定计算荷载比 =0.01

无防护下钢构件最大升温(Ts): 1081.87℃ ,按临界温度法求得临界温度(Td): 657.00℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.4843(m^2\*℃/w) ,计算所需保护层厚度(di) =48.43(mm)

构件重量 (Kg)=47.84

**4. 钢 柱 4
设计结果**

截面类型=16; 布置角度=0; 计算长度：Lx=3.00, Ly=1.50; 长细比：λx=35.5,λy=33.9

构件长度=1.53; 计算长度系数: Ux=1.96 Uy=0.98

抗震等级: 四级

截面参数: B1=180, B2=180, H=200, Tw=6, T1=8, T2=8

轴压截面分类:X轴:b类 , Y轴:c类

构件钢号：Q355

宽厚比等级:S4

验算规范: 门规GB51022-2015

构件耐火等级: 二级

是否耐火钢: 否; 采用防火材料: 防火涂料1( 1); 形状系数: 278.112457(1/m)

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 0.00 | 0.75 | 0.00 | 0.00 | 0.00 | -0.00 |
| 2 | 0.00 | 0.75 | -0.00 | -0.00 | 0.00 | 0.00 |
| 3 | 0.00 | 0.75 | -0.00 | -0.00 | 0.00 | 0.00 |
| 4 | 0.00 | 0.75 | 0.00 | 0.00 | 0.00 | -0.00 |
| 5 | 0.00 | 0.57 | 0.00 | 0.00 | 0.00 | -0.00 |
| 6 | 0.00 | 0.57 | -0.00 | -0.00 | 0.00 | 0.00 |
| 7 | 0.00 | 0.57 | -0.00 | -0.00 | 0.00 | 0.00 |
| 8 | 0.00 | 0.57 | 0.00 | 0.00 | 0.00 | -0.00 |
| 9 | 9.12 | 0.75 | 12.16 | 0.00 | 0.00 | -0.00 |
| 10 | -9.12 | 0.75 | -12.16 | 0.00 | 0.00 | -0.00 |
| 11 | 9.12 | 0.75 | 12.16 | -0.00 | 0.00 | 0.00 |
| 12 | -9.12 | 0.75 | -12.16 | 0.00 | 0.00 | -0.00 |
| 13 | 9.12 | 0.57 | 12.16 | 0.00 | 0.00 | -0.00 |
| 14 | -9.12 | 0.57 | -12.16 | 0.00 | 0.00 | -0.00 |
| 15 | 9.12 | 0.57 | 12.16 | -0.00 | 0.00 | 0.00 |
| 16 | -9.12 | 0.57 | -12.16 | 0.00 | 0.00 | -0.00 |
| 17 | 5.47 | 0.75 | 7.30 | 0.00 | 0.00 | -0.00 |
| 18 | -5.47 | 0.75 | -7.30 | 0.00 | 0.00 | -0.00 |
| 19 | 5.47 | 0.75 | 7.30 | -0.00 | 0.00 | 0.00 |
| 20 | -5.47 | 0.75 | -7.30 | 0.00 | 0.00 | -0.00 |
| 21 | 5.47 | 0.75 | 7.30 | 0.00 | 0.00 | -0.00 |
| 22 | -5.47 | 0.75 | -7.30 | -0.00 | 0.00 | -0.00 |
| 23 | 5.47 | 0.75 | 7.30 | -0.00 | 0.00 | 0.00 |
| 24 | -5.47 | 0.75 | -7.30 | 0.00 | 0.00 | -0.00 |
| 25 | 5.47 | 0.75 | 7.30 | 0.00 | 0.00 | -0.00 |
| 26 | -5.47 | 0.75 | -7.30 | -0.00 | 0.00 | -0.00 |
| 27 | 5.47 | 0.75 | 7.30 | -0.00 | 0.00 | 0.00 |
| 28 | -5.47 | 0.75 | -7.30 | 0.00 | 0.00 | -0.00 |
| 29 | 5.47 | 0.75 | 7.30 | 0.00 | 0.00 | -0.00 |
| 30 | -5.47 | 0.75 | -7.30 | 0.00 | 0.00 | -0.00 |
| 31 | 5.47 | 0.75 | 7.30 | -0.00 | 0.00 | 0.00 |
| 32 | -5.47 | 0.75 | -7.30 | 0.00 | 0.00 | -0.00 |
| 33 | 5.47 | 0.57 | 7.30 | 0.00 | 0.00 | -0.00 |
| 34 | -5.47 | 0.57 | -7.30 | 0.00 | 0.00 | -0.00 |
| 35 | 5.47 | 0.57 | 7.30 | -0.00 | 0.00 | 0.00 |
| 36 | -5.47 | 0.57 | -7.30 | 0.00 | 0.00 | -0.00 |
| 37 | 5.47 | 0.57 | 7.30 | 0.00 | 0.00 | -0.00 |
| 38 | -5.47 | 0.57 | -7.30 | 0.00 | 0.00 | -0.00 |
| 39 | 5.47 | 0.57 | 7.30 | -0.00 | 0.00 | 0.00 |
| 40 | -5.47 | 0.57 | -7.30 | 0.00 | 0.00 | -0.00 |
| 41 | 5.47 | 0.57 | 7.30 | 0.00 | 0.00 | -0.00 |
| 42 | -5.47 | 0.57 | -7.30 | 0.00 | 0.00 | -0.00 |
| 43 | 5.47 | 0.57 | 7.30 | -0.00 | 0.00 | 0.00 |
| 44 | -5.47 | 0.57 | -7.30 | 0.00 | 0.00 | -0.00 |
| 45 | 5.47 | 0.57 | 7.30 | 0.00 | 0.00 | -0.00 |
| 46 | -5.47 | 0.57 | -7.30 | 0.00 | 0.00 | -0.00 |
| 47 | 5.47 | 0.57 | 7.30 | -0.00 | 0.00 | 0.00 |
| 48 | -5.47 | 0.57 | -7.30 | 0.00 | 0.00 | -0.00 |
| 49 | 9.12 | 0.75 | 12.16 | 0.00 | 0.00 | -0.00 |
| 50 | -9.12 | 0.75 | -12.16 | 0.00 | 0.00 | -0.00 |
| 51 | 9.12 | 0.75 | 12.16 | -0.00 | 0.00 | 0.00 |
| 52 | -9.12 | 0.75 | -12.16 | 0.00 | 0.00 | -0.00 |
| 53 | 9.12 | 0.75 | 12.16 | 0.00 | 0.00 | -0.00 |
| 54 | -9.12 | 0.75 | -12.16 | 0.00 | 0.00 | -0.00 |
| 55 | 9.12 | 0.75 | 12.16 | -0.00 | 0.00 | 0.00 |
| 56 | -9.12 | 0.75 | -12.16 | 0.00 | 0.00 | -0.00 |
| 57 | 9.12 | 0.75 | 12.16 | 0.00 | 0.00 | -0.00 |
| 58 | -9.12 | 0.75 | -12.16 | 0.00 | 0.00 | -0.00 |
| 59 | 9.12 | 0.75 | 12.16 | -0.00 | 0.00 | 0.00 |
| 60 | -9.12 | 0.75 | -12.16 | 0.00 | 0.00 | -0.00 |
| 61 | 9.12 | 0.75 | 12.16 | 0.00 | 0.00 | -0.00 |
| 62 | -9.12 | 0.75 | -12.16 | 0.00 | 0.00 | -0.00 |
| 63 | 9.12 | 0.75 | 12.16 | -0.00 | 0.00 | 0.00 |
| 64 | -9.12 | 0.75 | -12.16 | 0.00 | 0.00 | -0.00 |
| 65 | 9.12 | 0.57 | 12.16 | 0.00 | 0.00 | -0.00 |
| 66 | -9.12 | 0.57 | -12.16 | 0.00 | 0.00 | -0.00 |
| 67 | 9.12 | 0.57 | 12.16 | -0.00 | 0.00 | 0.00 |
| 68 | -9.12 | 0.57 | -12.16 | 0.00 | 0.00 | -0.00 |
| 69 | 9.12 | 0.57 | 12.16 | 0.00 | 0.00 | -0.00 |
| 70 | -9.12 | 0.57 | -12.16 | 0.00 | 0.00 | -0.00 |
| 71 | 9.12 | 0.57 | 12.16 | -0.00 | 0.00 | 0.00 |
| 72 | -9.12 | 0.57 | -12.16 | 0.00 | 0.00 | -0.00 |
| 73 | 9.12 | 0.57 | 12.16 | 0.00 | 0.00 | -0.00 |
| 74 | -9.12 | 0.57 | -12.16 | 0.00 | 0.00 | -0.00 |
| 75 | 9.12 | 0.57 | 12.16 | -0.00 | 0.00 | 0.00 |
| 76 | -9.12 | 0.57 | -12.16 | 0.00 | 0.00 | -0.00 |
| 77 | 9.12 | 0.57 | 12.16 | 0.00 | 0.00 | -0.00 |
| 78 | -9.12 | 0.57 | -12.16 | 0.00 | 0.00 | -0.00 |
| 79 | 9.12 | 0.57 | 12.16 | -0.00 | 0.00 | 0.00 |
| 80 | -9.12 | 0.57 | -12.16 | 0.00 | 0.00 | -0.00 |
| 81 | 0.03 | 0.75 | 0.02 | 0.00 | 0.00 | -0.02 |
| 82 | -0.03 | 0.75 | -0.02 | 0.00 | 0.00 | 0.02 |
| 83 | 0.03 | 0.75 | 0.02 | -0.00 | 0.00 | -0.02 |
| 84 | -0.03 | 0.75 | -0.02 | -0.00 | 0.00 | 0.02 |
| 85 | 0.03 | 0.75 | 0.02 | -0.00 | 0.00 | -0.02 |
| 86 | -0.03 | 0.75 | -0.02 | -0.00 | 0.00 | 0.02 |
| 87 | 0.03 | 0.75 | 0.02 | 0.00 | 0.00 | -0.02 |
| 88 | -0.03 | 0.75 | -0.02 | 0.00 | 0.00 | 0.02 |
| 89 | 0.03 | 0.57 | 0.02 | -0.00 | 0.00 | -0.02 |
| 90 | -0.03 | 0.57 | -0.02 | 0.00 | 0.00 | 0.02 |
| 91 | 0.03 | 0.57 | 0.02 | -0.00 | 0.00 | -0.02 |
| 92 | -0.03 | 0.57 | -0.02 | -0.00 | 0.00 | 0.02 |
| 93 | 0.03 | 0.57 | 0.02 | -0.00 | 0.00 | -0.02 |
| 94 | -0.03 | 0.57 | -0.02 | -0.00 | 0.00 | 0.02 |
| 95 | 0.03 | 0.57 | 0.02 | -0.00 | 0.00 | -0.02 |
| 96 | -0.03 | 0.57 | -0.02 | 0.00 | 0.00 | 0.02 |

强度计算控制组合号: 49, M=9.12, N=0.75, M=0.00, N=0.00

强度计算应力比 =0.112

抗剪强度计算控制组合号: 77, V=12.16

抗剪强度计算应力比 =0.063

平面内稳定计算最大应力对应组合号: 49, M=9.12, N=0.75, M=0.00, N=0.00

平面内稳定计算最大应力 (N/mm\*mm) =30.96

平面内稳定计算最大应力比 =0.101

临界弯矩Mcr(kN\*m) =1309.58

平面外稳定计算最大应力比 =0.048

门规GB51022-2015腹板容许高厚比 [H0/TW] =250.00

翼缘容许宽厚比 [B/T] =12.20

强度计算应力比 =0.112 < 1.0

抗剪强度计算应力比 =0.063 < 1.0

平面内稳定计算最大应力 < f=305.00

平面外稳定计算最大应力比 < 1.0

腹板高厚比 H0/TW=30.67 < [H0/TW]=250.00

翼缘宽厚比 B/T =10.88 < [B/T]=12.20

压杆,平面内长细比 λ=35. ≤ [λ]=180

压杆,平面外长细比 λ=34. ≤ [λ]=180

钢构件防火设计结果:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 偶然组合 | | | | | | |
| \ | 柱 下 端 | | | 柱 上 端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 0.00 | 0.57 | 0.00 | 0.00 | 0.00 | -0.00 |
| 2 | 0.00 | 0.57 | -0.00 | -0.00 | 0.00 | 0.00 |
| 3 | 0.00 | 0.57 | -0.00 | -0.00 | 0.00 | 0.00 |
| 4 | 0.00 | 0.57 | 0.00 | 0.00 | 0.00 | -0.00 |
| 5 | 0.00 | 0.52 | 0.00 | 0.00 | 0.00 | -0.00 |
| 6 | 0.00 | 0.52 | -0.00 | -0.00 | 0.00 | 0.00 |
| 7 | 0.00 | 0.52 | -0.00 | -0.00 | 0.00 | 0.00 |
| 8 | 0.00 | 0.52 | 0.00 | 0.00 | 0.00 | -0.00 |
| 9 | 2.43 | 0.57 | 3.24 | 0.00 | 0.00 | 0.00 |
| 10 | -2.43 | 0.57 | -3.24 | 0.00 | 0.00 | -0.00 |
| 11 | 2.43 | 0.57 | 3.24 | -0.00 | 0.00 | 0.00 |
| 12 | -2.43 | 0.57 | -3.24 | 0.00 | 0.00 | -0.00 |
| 13 | 2.43 | 0.52 | 3.24 | 0.00 | 0.00 | -0.00 |
| 14 | -2.43 | 0.52 | -3.24 | 0.00 | 0.00 | -0.00 |
| 15 | 2.43 | 0.52 | 3.24 | -0.00 | 0.00 | 0.00 |
| 16 | -2.43 | 0.52 | -3.24 | 0.00 | 0.00 | -0.00 |

防火设计控制的偶然组合号: 9, M=2.43, N=0.57, M=0.00, N=0.00

强度计算荷载比 =0.03

平面内稳定计算荷载比 =0.03

平面外稳定计算荷载比 =0.01

无防护下钢构件最大升温(Ts): 1081.87℃ ,按临界温度法求得临界温度(Td): 657.00℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.4843(m^2\*℃/w) ,计算所需保护层厚度(di) =48.43(mm)

构件重量 (Kg)=47.84

**5、 钢 梁 1
设计结果**

截面类型=27; 布置角度=0; 计算长度： Lx=18.49

构件长度=9.24; 计算长度系数: Ux=2.00

支撑长度=9.04

隅撑作为梁面外弹性支撑点，以下为隅撑支撑信息：

隅撑截面:L50X5 ; 布置间距: 2.44

隅撑与檩条夹角(度): 45.00; 隅撑孔距檩条下边缘距离: 0.10

檩条截面:XZ200X70X20X2.0 ; 檩条跨度: 9.00; 檩条到梁上皮距离: 0.02

抗震等级: 四级

变截面 H 形截面 H: B1=220, B2=220, H1=600, H2=400 T1=6 T2=10 T3=10

轴压截面分类:X轴:b类 , Y轴:c类

构件钢号：Q355

宽厚比等级:S4

验算规范: 门规GB51022-2015

构件耐火等级: 二级

是否耐火钢: 否; 采用防火材料: 防火涂料2( 2); 形状系数: 257.837830(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | 310.24 | 80.66 | 111.99 | 176.14 | -69.05 | 6.75 |
| 2 | 148.01 | 38.46 | 53.42 | 84.01 | -32.92 | 3.22 |
| 3 | 238.07 | 61.17 | 99.20 | 130.07 | -49.56 | 19.54 |
| 4 | 220.18 | 57.95 | 66.21 | 130.07 | -52.41 | -9.57 |
| 5 | 276.08 | 71.79 | 99.66 | 156.75 | -61.45 | 6.01 |
| 6 | 113.86 | 29.58 | 41.09 | 64.62 | -25.32 | 2.48 |
| 7 | 203.92 | 52.30 | 86.87 | 110.68 | -41.96 | 18.80 |
| 8 | 186.02 | 49.07 | 53.88 | 110.68 | -44.81 | -10.31 |
| 9 | -12.45 | 8.94 | 4.75 | 26.40 | -3.40 | 1.73 |
| 10 | 98.42 | 9.21 | 25.97 | 26.40 | -3.67 | -1.04 |
| 11 | 40.07 | 28.50 | 23.59 | 52.14 | -22.96 | 3.64 |
| 12 | 150.94 | 28.77 | 44.81 | 52.14 | -23.23 | 0.87 |
| 13 | -46.60 | 0.07 | -7.58 | 7.02 | 4.20 | 0.99 |
| 14 | 64.27 | 0.34 | 13.64 | 7.02 | 3.93 | -1.78 |
| 15 | 5.91 | 19.62 | 11.26 | 32.75 | -15.36 | 2.90 |
| 16 | 116.78 | 19.89 | 32.48 | 32.75 | -15.63 | 0.13 |
| 17 | 213.96 | 62.95 | 82.78 | 141.57 | -51.34 | 5.86 |
| 18 | 280.48 | 63.11 | 95.51 | 141.57 | -51.50 | 4.20 |
| 19 | 245.47 | 74.69 | 94.09 | 157.01 | -63.07 | 7.01 |
| 20 | 311.99 | 74.85 | 106.82 | 157.01 | -63.23 | 5.35 |
| 21 | 51.74 | 20.75 | 24.22 | 49.44 | -15.21 | 2.33 |
| 22 | 118.26 | 20.91 | 36.95 | 49.44 | -15.37 | 0.66 |
| 23 | 83.25 | 32.48 | 35.52 | 64.88 | -26.94 | 3.47 |
| 24 | 149.77 | 32.64 | 48.25 | 64.88 | -27.10 | 1.81 |
| 25 | 141.80 | 43.46 | 69.99 | 95.51 | -31.85 | 18.65 |
| 26 | 208.32 | 43.63 | 82.73 | 95.51 | -32.01 | 16.99 |
| 27 | 173.31 | 55.20 | 81.30 | 110.95 | -43.58 | 19.80 |
| 28 | 239.83 | 55.36 | 94.03 | 110.95 | -43.74 | 18.14 |
| 29 | 123.90 | 40.24 | 37.01 | 95.51 | -34.70 | -10.46 |
| 30 | 190.42 | 40.40 | 49.74 | 95.51 | -34.86 | -12.12 |
| 31 | 155.41 | 51.97 | 48.31 | 110.95 | -46.43 | -9.32 |
| 32 | 221.93 | 52.13 | 61.04 | 110.95 | -46.59 | -10.98 |
| 33 | 179.80 | 54.08 | 70.46 | 122.19 | -43.74 | 5.12 |
| 34 | 246.33 | 54.24 | 83.19 | 122.19 | -43.90 | 3.46 |
| 35 | 211.31 | 65.81 | 81.76 | 137.63 | -55.47 | 6.27 |
| 36 | 277.83 | 65.97 | 94.49 | 137.63 | -55.64 | 4.60 |
| 37 | 17.58 | 11.87 | 11.89 | 30.06 | -7.61 | 1.58 |
| 38 | 84.10 | 12.04 | 24.62 | 30.06 | -7.77 | -0.08 |
| 39 | 49.09 | 23.61 | 23.20 | 45.50 | -19.34 | 2.73 |
| 40 | 115.61 | 23.77 | 35.93 | 45.50 | -19.51 | 1.07 |
| 41 | 107.64 | 34.59 | 57.67 | 76.12 | -24.25 | 17.91 |
| 42 | 174.16 | 34.75 | 70.40 | 76.12 | -24.41 | 16.25 |
| 43 | 139.15 | 46.32 | 68.97 | 91.56 | -35.98 | 19.06 |
| 44 | 205.67 | 46.48 | 81.70 | 91.56 | -36.15 | 17.39 |
| 45 | 89.74 | 31.36 | 24.68 | 76.12 | -27.10 | -11.21 |
| 46 | 156.27 | 31.52 | 37.41 | 76.12 | -27.26 | -12.87 |
| 47 | 121.25 | 43.10 | 35.99 | 91.56 | -38.83 | -10.06 |
| 48 | 187.77 | 43.26 | 48.72 | 91.56 | -39.00 | -11.72 |
| 49 | 101.11 | 38.48 | 45.75 | 90.89 | -28.69 | 4.20 |
| 50 | 211.98 | 38.76 | 66.96 | 90.89 | -28.96 | 1.44 |
| 51 | 153.62 | 58.04 | 64.59 | 116.63 | -48.25 | 6.12 |
| 52 | 264.49 | 58.31 | 85.81 | 116.63 | -48.52 | 3.35 |
| 53 | -12.45 | 8.94 | 4.75 | 26.40 | -3.40 | 1.73 |
| 54 | 98.42 | 9.21 | 25.97 | 26.40 | -3.67 | -1.04 |
| 55 | 40.07 | 28.50 | 23.59 | 52.14 | -22.96 | 3.64 |
| 56 | 150.94 | 28.77 | 44.81 | 52.14 | -23.23 | 0.87 |
| 57 | 50.60 | 24.84 | 36.79 | 58.65 | -15.05 | 13.16 |
| 58 | 161.47 | 25.11 | 58.01 | 58.65 | -15.32 | 10.39 |
| 59 | 103.11 | 44.40 | 55.64 | 84.38 | -34.60 | 15.07 |
| 60 | 213.98 | 44.67 | 76.85 | 84.38 | -34.88 | 12.30 |
| 61 | 38.07 | 22.58 | 13.70 | 58.65 | -17.04 | -7.22 |
| 62 | 148.94 | 22.85 | 34.92 | 58.65 | -17.31 | -9.99 |
| 63 | 90.58 | 42.14 | 32.55 | 84.38 | -36.60 | -5.31 |
| 64 | 201.45 | 42.41 | 53.76 | 84.38 | -36.87 | -8.08 |
| 65 | 66.95 | 29.61 | 33.42 | 71.51 | -21.09 | 3.46 |
| 66 | 177.82 | 29.88 | 54.64 | 71.51 | -21.37 | 0.69 |
| 67 | 119.47 | 49.17 | 52.26 | 97.24 | -40.65 | 5.37 |
| 68 | 230.34 | 49.44 | 73.48 | 97.24 | -40.92 | 2.61 |
| 69 | -46.60 | 0.07 | -7.58 | 7.02 | 4.20 | 0.99 |
| 70 | 64.27 | 0.34 | 13.64 | 7.02 | 3.93 | -1.78 |
| 71 | 5.91 | 19.62 | 11.26 | 32.75 | -15.36 | 2.90 |
| 72 | 116.78 | 19.89 | 32.48 | 32.75 | -15.63 | 0.13 |
| 73 | 16.44 | 15.97 | 24.47 | 39.26 | -7.45 | 12.41 |
| 74 | 127.31 | 16.24 | 45.68 | 39.26 | -7.72 | 9.65 |
| 75 | 68.95 | 35.52 | 43.31 | 65.00 | -27.01 | 14.33 |
| 76 | 179.82 | 35.79 | 64.53 | 65.00 | -27.28 | 11.56 |
| 77 | 3.91 | 13.71 | 1.38 | 39.26 | -9.45 | -7.97 |
| 78 | 114.78 | 13.98 | 22.59 | 39.26 | -9.72 | -10.73 |
| 79 | 56.42 | 33.26 | 20.22 | 65.00 | -29.00 | -6.05 |
| 80 | 167.29 | 33.54 | 41.44 | 65.00 | -29.27 | -8.82 |
| 81 | 208.77 | 55.50 | 77.77 | 123.93 | -47.32 | 5.78 |
| 82 | 227.86 | 57.99 | 79.83 | 123.93 | -49.82 | 3.72 |
| 83 | 138.47 | 37.21 | 52.39 | 84.01 | -31.67 | 4.25 |
| 84 | 157.56 | 39.71 | 54.45 | 84.01 | -34.17 | 2.19 |
| 85 | 177.50 | 47.05 | 72.22 | 103.97 | -38.88 | 11.33 |
| 86 | 196.59 | 49.55 | 74.29 | 103.97 | -41.38 | 9.26 |
| 87 | 169.74 | 45.65 | 57.93 | 103.97 | -40.11 | -1.29 |
| 88 | 188.83 | 48.15 | 59.99 | 103.97 | -42.61 | -3.35 |
| 89 | 158.39 | 42.40 | 59.58 | 95.33 | -36.12 | 4.69 |
| 90 | 177.48 | 44.90 | 61.65 | 95.33 | -38.61 | 2.62 |
| 91 | 104.31 | 28.33 | 40.06 | 64.62 | -24.07 | 3.51 |
| 92 | 123.40 | 30.83 | 42.12 | 64.62 | -26.57 | 1.44 |
| 93 | 134.33 | 35.91 | 55.32 | 79.98 | -29.62 | 8.95 |
| 94 | 153.42 | 38.40 | 57.38 | 79.98 | -32.12 | 6.89 |
| 95 | 128.37 | 34.83 | 44.32 | 79.98 | -30.57 | -0.75 |
| 96 | 147.46 | 37.33 | 46.39 | 79.98 | -33.07 | -2.82 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -46.60 | -35.77 | -40.01 | -83.20 | -129.31 | -144.94 | -176.14 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 311.99 | 100.49 | 31.21 | 14.92 | 4.56 | 0.00 | 0.00 |

强度计算应力比 =0.734

抗剪强度计算应力比 =0.367

平面内稳定计算最大应力对应组合号: 1, M=310.24, N=80.66, M=176.14, N=-69.05

平面内稳定最大应力 (N/mm\*mm) =217.03

平面内稳定计算最大应力比 =0.712

临界弯矩Mcr(kN\*m) =832.27

平面外稳定计算最大应力比 =0.716

梁面外稳定计算方式：梁面外稳定按隅撑间距计算。

强度计算应力比 =0.734 < 1.0

抗剪强度计算应力比 =0.367 < 1.0

平面内稳定最大应力 < f=305.00

平面外稳定计算最大应力比 =0.716 < 1.0

腹板高厚比 H0/TW=80.00 < [H0/TW]=250.00 (GB51022-2015)

翼缘宽厚比 B/T =10.70 < [B/T] =12.20

**(恒+活)梁的挠度 mm**

| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0.00 | 13.00 | 28.05 | 43.02 | 55.91 | 64.95 | 68.88 |

最大挠度值 =68.88 最大挠度/梁跨度 =1/267.

斜梁坡度初始值: 1/10.22

变形后斜梁坡度最小值: 1/11.38

变形后斜梁坡度改变率 =0.102 < 1/3

钢构件防火设计结果:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 偶然组合 | | | | | | |
| \ | I端 |  |  | II端 |  |  |
| 组合 | M | N | V | M | N | V |
| 1 | 167.93 | 43.65 | 60.61 | 95.33 | -37.36 | 3.66 |
| 2 | 113.86 | 29.58 | 41.09 | 64.62 | -25.32 | 2.48 |
| 3 | 143.88 | 37.15 | 56.35 | 79.98 | -30.87 | 7.92 |
| 4 | 137.91 | 36.08 | 45.36 | 79.98 | -31.82 | -1.79 |
| 5 | 156.55 | 40.69 | 56.50 | 88.87 | -34.83 | 3.41 |
| 6 | 102.47 | 26.62 | 36.98 | 58.16 | -22.79 | 2.23 |
| 7 | 132.49 | 34.20 | 52.24 | 73.51 | -28.34 | 7.67 |
| 8 | 126.53 | 33.12 | 41.25 | 73.51 | -29.28 | -2.03 |
| 9 | 71.07 | 21.71 | 28.11 | 49.26 | -17.45 | 2.08 |
| 10 | 100.63 | 21.78 | 33.77 | 49.26 | -17.52 | 1.34 |
| 11 | 85.07 | 26.93 | 33.14 | 56.12 | -22.66 | 2.59 |
| 12 | 114.64 | 27.00 | 38.80 | 56.12 | -22.74 | 1.85 |
| 13 | 59.68 | 18.75 | 24.00 | 42.80 | -14.92 | 1.83 |
| 14 | 89.25 | 18.83 | 29.66 | 42.80 | -14.99 | 1.09 |
| 15 | 73.69 | 23.97 | 29.03 | 49.66 | -20.13 | 2.34 |
| 16 | 103.25 | 24.04 | 34.69 | 49.66 | -20.20 | 1.60 |

--- 梁的弯矩包络(偶然组合) ---

梁下部受拉:

截面 1 2 3 4 5 6 7

弯矩 0.00 0.00 -1.01 -42.31 -71.37 -83.92 -95.33

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 167.93 65.31 14.60 0.00 0.00 0.00 0.00

强度计算荷载比 =0.40

平面内稳定计算荷载比 =0.38

平面外稳定计算荷载比 =0.28

无防护下钢构件最大升温(Ts): 1004.72℃ ,按临界温度法求得临界温度(Td): 618.10℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.2652(m^2\*℃/w)

构件重量 (Kg)=528.27

**6、 钢 梁 2
设计结果**

截面类型=27; 布置角度=0; 计算长度： Lx=18.49

构件长度=9.24; 计算长度系数: Ux=2.00

支撑长度=9.04

隅撑作为梁面外弹性支撑点，以下为隅撑支撑信息：

隅撑截面:L50X5 ; 布置间距: 2.44

隅撑与檩条夹角(度): 45.00; 隅撑孔距檩条下边缘距离: 0.10

檩条截面:XZ200X70X20X2.0 ; 檩条跨度: 9.00; 檩条到梁上皮距离: 0.02

抗震等级: 四级

变截面 H 形截面 H: B1=220, B2=220, H1=400, H2=600 T1=6 T2=10 T3=10

轴压截面分类:X轴:b类 , Y轴:c类

构件钢号：Q355

宽厚比等级:S4

验算规范: 门规GB51022-2015

构件耐火等级: 二级

是否耐火钢: 否; 采用防火材料: 防火涂料2( 2); 形状系数: 257.837830(1/m)

梁刚度放大系数: 1.0

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| \ | I端 | | | II端 | | |
| 组合 | M | N | V | M | N | V |
| 1 | -84.01 | 32.92 | 3.22 | -148.01 | -38.46 | 53.42 |
| 2 | -176.14 | 69.05 | 6.75 | -310.24 | -80.66 | 111.99 |
| 3 | -130.07 | 49.56 | 19.54 | -238.07 | -61.17 | 99.20 |
| 4 | -130.07 | 52.41 | -9.57 | -220.18 | -57.95 | 66.21 |
| 5 | -64.62 | 25.32 | 2.48 | -113.86 | -29.58 | 41.09 |
| 6 | -156.75 | 61.45 | 6.01 | -276.08 | -71.79 | 99.66 |
| 7 | -110.68 | 41.96 | 18.80 | -203.92 | -52.30 | 86.87 |
| 8 | -110.68 | 44.81 | -10.31 | -186.02 | -49.07 | 53.88 |
| 9 | -26.40 | 3.67 | -1.04 | -98.42 | -9.21 | 25.97 |
| 10 | -26.40 | 3.40 | 1.73 | 12.45 | -8.94 | 4.75 |
| 11 | -52.14 | 23.23 | 0.87 | -150.94 | -28.77 | 44.81 |
| 12 | -52.14 | 22.96 | 3.64 | -40.07 | -28.50 | 23.59 |
| 13 | -7.02 | -3.93 | -1.78 | -64.27 | -0.34 | 13.64 |
| 14 | -7.02 | -4.20 | 0.99 | 46.60 | -0.06 | -7.58 |
| 15 | -32.75 | 15.63 | 0.13 | -116.78 | -19.89 | 32.48 |
| 16 | -32.75 | 15.36 | 2.90 | -5.91 | -19.62 | 11.26 |
| 17 | -49.44 | 15.37 | 0.66 | -118.26 | -20.91 | 36.95 |
| 18 | -49.44 | 15.21 | 2.33 | -51.74 | -20.75 | 24.22 |
| 19 | -64.88 | 27.10 | 1.81 | -149.77 | -32.64 | 48.25 |
| 20 | -64.88 | 26.94 | 3.47 | -83.25 | -32.48 | 35.52 |
| 21 | -141.57 | 51.50 | 4.20 | -280.48 | -63.11 | 95.51 |
| 22 | -141.57 | 51.34 | 5.86 | -213.96 | -62.95 | 82.78 |
| 23 | -157.01 | 63.23 | 5.35 | -311.99 | -74.85 | 106.82 |
| 24 | -157.01 | 63.07 | 7.01 | -245.47 | -74.69 | 94.09 |
| 25 | -95.51 | 32.01 | 16.99 | -208.32 | -43.63 | 82.73 |
| 26 | -95.51 | 31.85 | 18.65 | -141.80 | -43.46 | 69.99 |
| 27 | -110.95 | 43.74 | 18.14 | -239.83 | -55.36 | 94.03 |
| 28 | -110.95 | 43.58 | 19.80 | -173.31 | -55.20 | 81.30 |
| 29 | -95.51 | 34.86 | -12.12 | -190.42 | -40.40 | 49.74 |
| 30 | -95.51 | 34.69 | -10.46 | -123.90 | -40.24 | 37.01 |
| 31 | -110.95 | 46.59 | -10.98 | -221.93 | -52.13 | 61.04 |
| 32 | -110.95 | 46.43 | -9.32 | -155.41 | -51.97 | 48.31 |
| 33 | -30.06 | 7.77 | -0.08 | -84.10 | -12.04 | 24.62 |
| 34 | -30.06 | 7.61 | 1.58 | -17.58 | -11.87 | 11.89 |
| 35 | -45.50 | 19.51 | 1.07 | -115.61 | -23.77 | 35.93 |
| 36 | -45.50 | 19.34 | 2.73 | -49.09 | -23.61 | 23.20 |
| 37 | -122.19 | 43.90 | 3.46 | -246.33 | -54.24 | 83.19 |
| 38 | -122.19 | 43.74 | 5.12 | -179.80 | -54.08 | 70.46 |
| 39 | -137.63 | 55.64 | 4.60 | -277.83 | -65.97 | 94.49 |
| 40 | -137.63 | 55.47 | 6.27 | -211.31 | -65.81 | 81.76 |
| 41 | -76.12 | 24.41 | 16.25 | -174.16 | -34.75 | 70.40 |
| 42 | -76.12 | 24.25 | 17.91 | -107.64 | -34.59 | 57.67 |
| 43 | -91.56 | 36.15 | 17.39 | -205.67 | -46.48 | 81.70 |
| 44 | -91.56 | 35.98 | 19.06 | -139.15 | -46.32 | 68.97 |
| 45 | -76.12 | 27.26 | -12.87 | -156.27 | -31.52 | 37.41 |
| 46 | -76.12 | 27.10 | -11.21 | -89.74 | -31.36 | 24.68 |
| 47 | -91.56 | 39.00 | -11.72 | -187.77 | -43.26 | 48.72 |
| 48 | -91.56 | 38.83 | -10.06 | -121.25 | -43.10 | 35.99 |
| 49 | -26.40 | 3.67 | -1.04 | -98.42 | -9.21 | 25.97 |
| 50 | -26.40 | 3.40 | 1.73 | 12.45 | -8.94 | 4.75 |
| 51 | -52.14 | 23.23 | 0.87 | -150.94 | -28.77 | 44.81 |
| 52 | -52.14 | 22.96 | 3.64 | -40.07 | -28.50 | 23.59 |
| 53 | -90.89 | 28.96 | 1.44 | -211.98 | -38.75 | 66.96 |
| 54 | -90.89 | 28.69 | 4.20 | -101.11 | -38.48 | 45.75 |
| 55 | -116.63 | 48.52 | 3.35 | -264.49 | -58.31 | 85.81 |
| 56 | -116.63 | 48.25 | 6.12 | -153.62 | -58.04 | 64.59 |
| 57 | -58.65 | 15.32 | 10.39 | -161.47 | -25.11 | 58.01 |
| 58 | -58.65 | 15.05 | 13.16 | -50.60 | -24.84 | 36.79 |
| 59 | -84.38 | 34.88 | 12.30 | -213.98 | -44.67 | 76.85 |
| 60 | -84.38 | 34.60 | 15.07 | -103.11 | -44.40 | 55.64 |
| 61 | -58.65 | 17.31 | -9.99 | -148.94 | -22.85 | 34.92 |
| 62 | -58.65 | 17.04 | -7.22 | -38.07 | -22.58 | 13.70 |
| 63 | -84.38 | 36.87 | -8.08 | -201.45 | -42.41 | 53.76 |
| 64 | -84.38 | 36.60 | -5.31 | -90.58 | -42.14 | 32.55 |
| 65 | -7.02 | -3.93 | -1.78 | -64.27 | -0.34 | 13.64 |
| 66 | -7.02 | -4.20 | 0.99 | 46.60 | -0.06 | -7.58 |
| 67 | -32.75 | 15.63 | 0.13 | -116.78 | -19.89 | 32.48 |
| 68 | -32.75 | 15.36 | 2.90 | -5.91 | -19.62 | 11.26 |
| 69 | -71.51 | 21.37 | 0.69 | -177.82 | -29.88 | 54.64 |
| 70 | -71.51 | 21.09 | 3.46 | -66.95 | -29.61 | 33.42 |
| 71 | -97.24 | 40.92 | 2.61 | -230.34 | -49.44 | 73.48 |
| 72 | -97.24 | 40.65 | 5.37 | -119.47 | -49.17 | 52.26 |
| 73 | -39.26 | 7.72 | 9.65 | -127.31 | -16.24 | 45.68 |
| 74 | -39.26 | 7.45 | 12.41 | -16.44 | -15.97 | 24.47 |
| 75 | -65.00 | 27.28 | 11.56 | -179.82 | -35.79 | 64.53 |
| 76 | -65.00 | 27.01 | 14.33 | -68.95 | -35.52 | 43.31 |
| 77 | -39.26 | 9.72 | -10.73 | -114.78 | -13.98 | 22.59 |
| 78 | -39.26 | 9.44 | -7.97 | -3.91 | -13.71 | 1.38 |
| 79 | -65.00 | 29.27 | -8.82 | -167.29 | -33.54 | 41.44 |
| 80 | -65.00 | 29.00 | -6.05 | -56.42 | -33.26 | 20.22 |
| 81 | -84.01 | 34.17 | 2.19 | -157.56 | -39.71 | 54.45 |
| 82 | -84.01 | 31.67 | 4.25 | -138.47 | -37.21 | 52.39 |
| 83 | -123.93 | 49.82 | 3.72 | -227.86 | -57.99 | 79.83 |
| 84 | -123.93 | 47.32 | 5.78 | -208.77 | -55.50 | 77.77 |
| 85 | -103.97 | 41.38 | 9.26 | -196.59 | -49.55 | 74.29 |
| 86 | -103.97 | 38.88 | 11.33 | -177.50 | -47.05 | 72.22 |
| 87 | -103.97 | 42.61 | -3.35 | -188.83 | -48.15 | 59.99 |
| 88 | -103.97 | 40.11 | -1.29 | -169.74 | -45.65 | 57.93 |
| 89 | -64.62 | 26.57 | 1.44 | -123.40 | -30.83 | 42.12 |
| 90 | -64.62 | 24.07 | 3.51 | -104.31 | -28.33 | 40.06 |
| 91 | -95.33 | 38.61 | 2.62 | -177.48 | -44.90 | 61.65 |
| 92 | -95.33 | 36.12 | 4.69 | -158.39 | -42.40 | 59.58 |
| 93 | -79.98 | 32.12 | 6.89 | -153.42 | -38.40 | 57.38 |
| 94 | -79.98 | 29.62 | 8.95 | -134.33 | -35.91 | 55.32 |
| 95 | -79.98 | 33.07 | -2.82 | -147.46 | -37.33 | 46.39 |
| 96 | -79.98 | 30.57 | -0.75 | -128.37 | -34.83 | 44.32 |

**梁的弯矩包络**

| 梁下部受拉 | | | | | | | |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | -176.14 | -144.94 | -129.31 | -83.20 | -40.01 | -35.77 | -46.60 |
| 梁上部受拉 | | | | | | | |
| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|  | 0.00 | 0.00 | 4.56 | 14.92 | 31.21 | 100.49 | 311.99 |

强度计算应力比 =0.734

抗剪强度计算应力比 =0.367

平面内稳定计算最大应力对应组合号: 1, M=-84.01, N=32.92, M=-148.01, N=-38.46

平面内稳定最大应力 (N/mm\*mm) =217.03

平面内稳定计算最大应力比 =0.712

临界弯矩Mcr(kN\*m) =832.27

平面外稳定计算最大应力比 =0.716

梁面外稳定计算方式：梁面外稳定按隅撑间距计算。

强度计算应力比 =0.734 < 1.0

抗剪强度计算应力比 =0.367 < 1.0

平面内稳定最大应力 < f=305.00

平面外稳定计算最大应力比 =0.716 < 1.0

腹板高厚比 H0/TW=80.00 < [H0/TW]=250.00 (GB51022-2015)

翼缘宽厚比 B/T =10.70 < [B/T] =12.20

**(恒+活)梁的挠度 mm**

| 截面 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | 68.88 | 64.95 | 55.91 | 43.02 | 28.05 | 13.00 | 0.00 |

最大挠度值 =68.88 最大挠度/梁跨度 =1/267.

斜梁坡度初始值: 1/10.22

变形后斜梁坡度最小值: 1/11.38

变形后斜梁坡度改变率 =0.102 < 1/3

钢构件防火设计结果:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| 偶然组合 | | | | | | |
| \ | I端 |  |  | II端 |  |  |
| 组合 | M | N | V | M | N | V |
| 1 | -64.62 | 25.32 | 2.48 | -113.86 | -29.58 | 41.09 |
| 2 | -95.33 | 37.36 | 3.66 | -167.93 | -43.65 | 60.61 |
| 3 | -79.98 | 30.87 | 7.92 | -143.88 | -37.15 | 56.35 |
| 4 | -79.98 | 31.82 | -1.79 | -137.91 | -36.08 | 45.36 |
| 5 | -58.16 | 22.79 | 2.23 | -102.47 | -26.62 | 36.98 |
| 6 | -88.87 | 34.83 | 3.41 | -156.55 | -40.69 | 56.50 |
| 7 | -73.51 | 28.34 | 7.67 | -132.49 | -34.20 | 52.24 |
| 8 | -73.51 | 29.28 | -2.03 | -126.53 | -33.12 | 41.25 |
| 9 | -49.26 | 17.52 | 1.34 | -100.63 | -21.78 | 33.77 |
| 10 | -49.26 | 17.45 | 2.08 | -71.07 | -21.71 | 28.11 |
| 11 | -56.12 | 22.74 | 1.85 | -114.64 | -27.00 | 38.80 |
| 12 | -56.12 | 22.66 | 2.59 | -85.07 | -26.93 | 33.14 |
| 13 | -42.80 | 14.99 | 1.09 | -89.25 | -18.83 | 29.66 |
| 14 | -42.80 | 14.92 | 1.83 | -59.68 | -18.75 | 24.00 |
| 15 | -49.66 | 20.20 | 1.60 | -103.25 | -24.04 | 34.69 |
| 16 | -49.66 | 20.13 | 2.34 | -73.69 | -23.97 | 29.03 |

--- 梁的弯矩包络(偶然组合) ---

梁下部受拉:

截面 1 2 3 4 5 6 7

弯矩 -95.33 -83.92 -71.37 -42.31 -1.01 0.00 0.00

梁上部受拉:

截面 1 2 3 4 5 6 7

弯矩 0.00 0.00 0.00 0.00 14.60 65.31 167.93

强度计算荷载比 =0.40

平面内稳定计算荷载比 =0.38

平面外稳定计算荷载比 =0.28

无防护下钢构件最大升温(Ts): 1004.72℃ ,按临界温度法求得临界温度(Td): 618.10℃

钢构件需要进行防火保护

计算所需等效热阻(Ri) =0.2652(m^2\*℃/w)

构件重量 (Kg)=528.27

风荷载作用下柱顶最大水平（X 向）位移:

节点( 2), 水平位移 dx=13.224(mm) =H /537.

地震荷载作用下柱顶最大水平（X 向）位移:

节点( 1), 水平位移 dx=2.346(mm) =H /3027.

梁的(恒+活)最大挠度:

梁( 1), 挠跨比 =1 /267.

风载作用下柱顶最大水平位移: H/537< 柱顶位移容许值: H/60

地震作用下柱顶最大水平位移: H/3027< 柱顶位移容许值: H/60

梁的(恒+活)最大挠跨比: 1/267< 梁的容许挠跨比: 1/240

所有钢柱的总重量 (Kg)=1017.

所有钢梁的总重量 (Kg)=1057.

钢梁与钢柱重量之和 (Kg)=2073.

**12. 荷载与计算结果简图**

## **1. 结构简图**



[图12-1 刚架简图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\刚架简图.T)

## **2. 荷载简图**



[图12-2 恒载简图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\恒载简图.T)



[图12-3 活载简图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\活载简图.T)



[图12-4 左风1简图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\左风1简图.T)



[图12-5 右风1简图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\右风1简图.T)



[图12-6 左风2简图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\左风2简图.T)



[图12-7 右风2简图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\右风2简图.T)

## **3. 应力比图**



[图12-8 应力比图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\应力比图.T)



[图12-9 荷载比图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\荷载比图.T)



[图12-10 防火图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\防火图.T)

## **4. 内力图**



[图12-11 恒载弯矩图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\恒载弯矩图.T)



[图12-12 恒载剪力图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\恒载剪力图.T)



[图12-13 恒载轴力图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\恒载轴力图.T)



[图12-14 活载弯矩图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\活载弯矩图.T)



[图12-15 活载剪力图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\活载剪力图.T)



[图12-16 活载轴力图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\活载轴力图.T)



[图12-17 左风1弯矩图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\左风1弯矩图.T)



[图12-18 右风1弯矩图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\右风1弯矩图.T)



[图12-19 左风1剪力图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\左风1剪力图.T)



[图12-20 右风1剪力图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\右风1剪力图.T)



[图12-21 左风1轴力图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\左风1轴力图.T)



[图12-22 右风1轴力图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\右风1轴力图.T)



[图12-23 左风2弯矩图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\左风2弯矩图.T)



[图12-24 右风2弯矩图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\右风2弯矩图.T)



[图12-25 左风2剪力图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\左风2剪力图.T)



[图12-26 右风2剪力图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\右风2剪力图.T)



[图12-27 左风2轴力图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\左风2轴力图.T)



[图12-28 右风2轴力图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\右风2轴力图.T)



[图12-29 左地震弯矩图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\左地震弯矩图.T)



[图12-30 右地震弯矩图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\右地震弯矩图.T)



[图12-31 左地震剪力图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\左地震剪力图.T)



[图12-32 右地震剪力图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\右地震剪力图.T)



[图12-33 左地震轴力图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\左地震轴力图.T)



[图12-34 右地震轴力图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\右地震轴力图.T)



[图12-35 弯矩包络图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\弯矩包络图.T)



[图12-36 剪力包络图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\剪力包络图.T)



[图12-37 轴力包络图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\轴力包络图.T)

## **5. 位移图**



[图12-38 恒载位移图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\恒载位移图.T)



[图12-39 活载位移图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\活载位移图.T)



[图12-40 左风1位移图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\左风1位移图.T)



[图12-41 右风1位移图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\右风1位移图.T)



[图12-42 左风2位移图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\左风2位移图.T)



[图12-43 右风2位移图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\右风2位移图.T)



[图12-44 左地震位移图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\左地震位移图.T)



[图12-45 右地震位移图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\右地震位移图.T)



[图12-46 恒+活位移图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\恒+活位移图.T)

## **6. 挠度图**



[图12-47 (恒+活)挠度图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\(恒+活)挠度图.T)



[图12-48 (活)挠度图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\(活)挠度图.T)



[图12-49 斜梁计算坡度图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\斜梁计算坡度图.T)



[图12-50 抗风柱挠度图](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\抗风柱挠度图.T)

## **7. 计算长度系数图**



[图12-51 平面内计算长度系数](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\平面内计算长度系数.T)



[图12-52 平面外计算长度系数](F:\\项目人\\大兵\\2025\\10\\修改的施工图\\02包装车间\\包装车间\\GJ1\\CalcTemp\\平面外计算长度系数.T)