

### 3. Gypsum tests

#### 3. فحوصات الجص

##### 1.3 فحص نعومة الجص Fineness Test

##### Objective:

Find the percentage of particles passing through Sieve No. 16 (1.18 mm) so that the plaster is free from crystals formed by moisture or containing impurities.

##### Standard Specification:

The Iraqi standard specifications adopted in this test were:

- Iraqi standard specification No. 27 /1985 (IQS 27-1985)

##### Apparatus:

- Sieve No.16 (opening diameter is 1.18 mm)
- Accurate balance
- Shaker
- Pan

##### Procedure:

1. Prepare (200) gm of gypsum
2. Place the pan and sieve in the shaker, then add the gypsum specimens in the sieve and cover the sieve.
3. Operate the shaker for (3) minute.
4. Weight the retained gypsum on the sieve NO. 16

##### Calculation:

- The Fineness of gypsum is calculating from the following equation:

$$\% \text{Fineness} = \frac{\text{Retained weight of gypsum on the sieve No. 16}}{\text{Total weight of gypsum}} \times 100$$

### **Specification Limits:**

**Iraqi standard specification No. 28 specifies the max. limits of fineness percentage for each type of gypsum as shown below:**

الحد الاعلى لدرجة النعومة %	نوع الجص
8	الجص الاعتيادي
صفر	البورك
5	الجص الفني

### **Discussion:**

- 1. Calculate the fineness percentage**
- 2. Compare the fineness percentage with the Iraqi specification limits and mention the specification limit of tested gypsum**
- 3. Mention the type of tested gypsum**
- 4. Mention the sieve No. and sieve's size used in the test**
- 5. Mention the duration of shaker's operation**

## 2.3 فحص القوام القياسي لعجينة الجص Gypsum Consistency Test

### Objective:

Specify the amount of water required to be added to the gypsum to get standard consistency.

### Standard Specification:

The Iraqi standard specifications adopted in this test were:

- Iraqi standard specification No. 27 /1985 (IQS 27-1985)

### Apparatus:

- a conical mold made of non -corroding and non -absorbed material, with an inside diameter (35) mm and (51) mm height
- Square glass of base plate with (250) mm in rib length
- Spatula of (20) mm in width (knife)
- Clan and dry mix bowl for mixing from non -corroding and non -absorbed material.
- Timer

### Procedure:

1. Clan up and dry the mold and the glass baseboard
2. Place the mold in the center of the base plate
3. Besprinkle at least (75) gm of gypsum on known volume of water (40-50) cm<sup>3</sup> in the mixing pan through (15) seconds.
4. Wait (30) seconds with gently knock on the pan for removing the air bubbles
5. Mix the gypsum with water by spatula for (30) seconds and with (50-60) blow in minutes.
6. Place the gypsum paste into the mold until the mold is fill
7. Remove the mold after (2) minutes from the moment of adding gypsum to the water and let the mixture to spread.
8. Measure the maximum and minimum diameter after spreading
9. Repeat the procedure with changing the amount of water until we have an average diameters equal to (100±3)mm

$$\frac{\text{Max. diameter} + \text{Min. diameter}}{2} = 100 \pm 3 \text{ mm}$$

**Calculation:**

- The consistency of gypsum is calculating from the following equation:

$$\% \text{ Standard Consistency} = \frac{W}{G} \times 100$$

**Where:**

**W:** water volume used to get the standard diffusing

**G:** total weight of gypsum

**Discussion:**

1. Calculate the standard consistency percentage
2. The duration from adding the gypsum to water until separation of mixture was:
  - a) 15 seconds
  - b) 30 seconds
  - c) 2 minutes
3. How many times we should repeat the procedure?
4. What is the equation of standard diffusing? and what it's value according to the IQS-27

### 3.3 فحص وقت التماسك للجص Setting Time Test

#### Objective:

Specify the required time to gypsum's setting after adding the water into the gypsum.

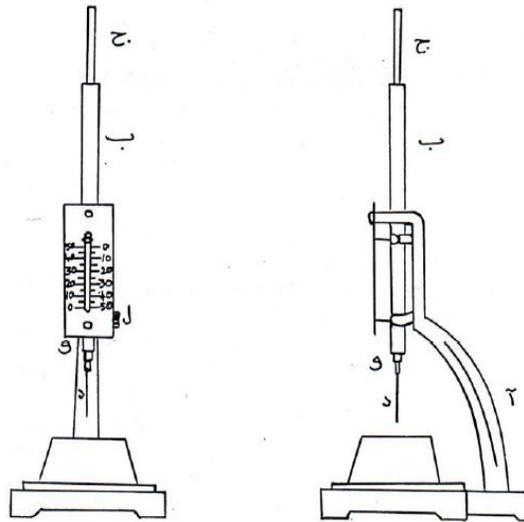
#### Standard Specification:

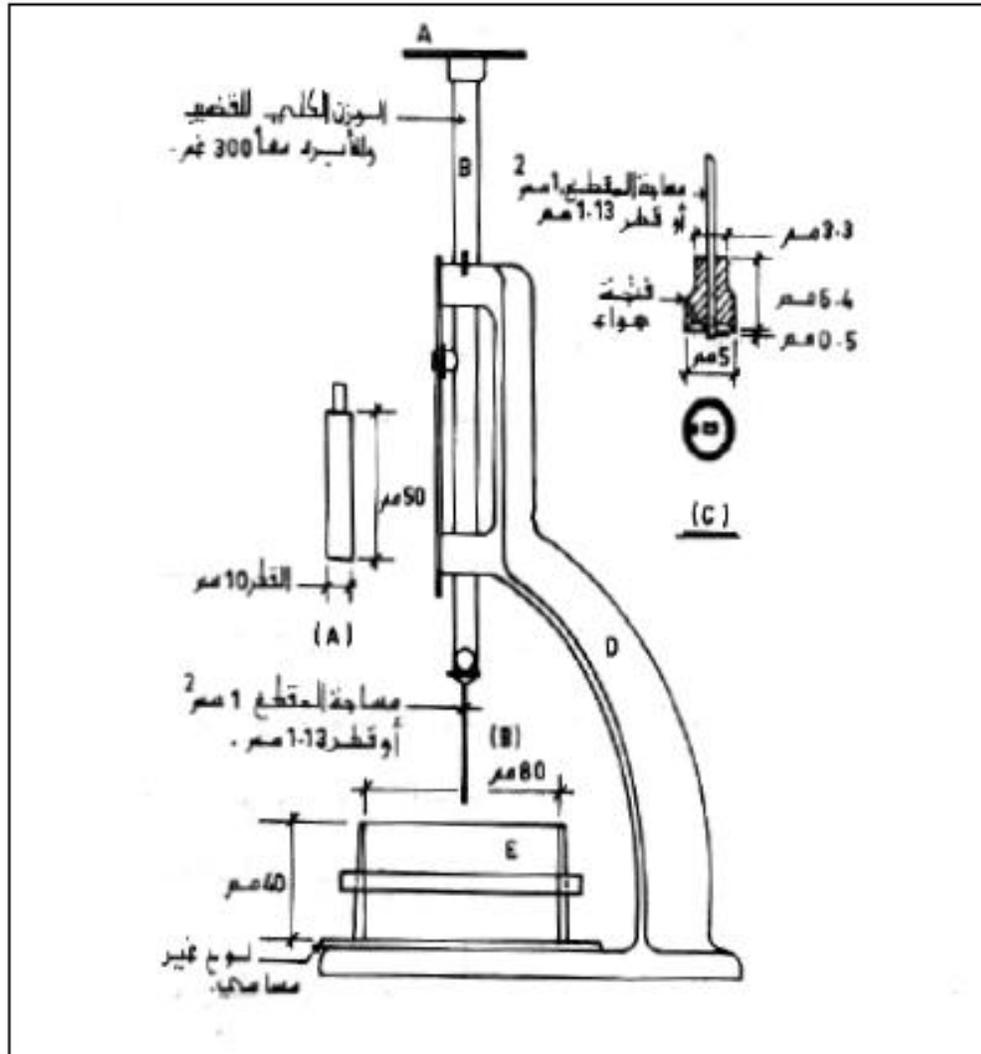
The Iraqi standard specifications adopted in this test were:

- Iraqi standard specification No. 27 /1985 (IQS 27-1985)

#### Apparatus:

- Vicate apparatus with needle of (1 mm) diameter (as shown in figure below)
- Base plate
- A conical ring mold which has a (70 mm) diameter for lower base, (60mm) diameter for upper base and (40mm) height.
- Timer
- Knife
- Mixing plate
- Accurate balance
- Oil





### **Procedure:**

1. Place Vicate apparatus, then applying thin coat of suitable oil to the mold and base plate it into Vicate apparatus
2. Weight (200) gm of gypsum sample
3. Prepare quantity of water which is calculated from normal consistency depending on the weight of sample
4. Adding the gypsum to required water and mix it together on the mixing plate
5. Operate the time from the moment of adding the gypsum to the water
6. Pour the mixture into the mold and flat the surface with knife
7. Lower the Vicate needle until contact the surface of gypsum paste and penetrate through it
8. Repeat the operation from time to time

9. The distance between each attempt and between the edge of mold not less than 12 mm
10. The setting time will be considered when the needle no longer penetrate to the bottom of base plate
11. The final setting time in minutes is considered from the time of adding the gypsum to the water until the time of complete setting of gypsum paste.

**Calculation:**

- The required amount of water is specifying from the consistency test

$$W = \frac{\text{Normal Consistency}}{100} \times G$$

Where:

W: Volume of water in (ml)

G: Weight of gypsum in (gm)

**Specification Limits:**

Iraqi standard specification No. 28 specifies the max. limits of setting time for each type of gypsum as shown below:

وقت التماسك (دقيقة)	نوع الجص
25-8	الجص الاعتيادي
25-8	البورك
20-12	الجص الفني

- The setting time of gypsum should not more that (15 min.) when it used for building trimmings.

**Discussion:**

1. What is the final setting time of tested gypsum for this test?
2. Compare the results with the Iraqi standard specification No. 28?
3. Clarify the setting time of gypsum?
4. What is the diameter of Vicate needle?

### 4.3 فحص تحمل الضغط لعجينة الجص Compressive Strength Test

#### Objective:

Specify the compression strength of gypsum specimens.

#### Standard Specification:

The Iraqi standard specifications adopted in this test were:

- Iraqi standard specification No. 27 /1985 (IQS 27-1985)

#### Apparatus:

- Specimen's molds of (50x50x50) mm made of non-corrodible material for compressive strength test.
- Accurate balance
- Oil
- Knife
- Mixing bowl (clean and dry)

#### Procedure:

1. Applying a thin layer of suitable oil to the cast mold
2. Prepare a gypsum pate according to the previous tests (Take 1000 gm of gypsum)
3. Add the gypsum paste into the cubic mold in two layers, each layer (25mm) in height
4. Scrolling the gypsum paste with the knife gently for (5) times to remove the bubbles for each of two layers
5. Flat the surface with knife
6. After the gypsum specimens were hardened, it will remove from the mold
7. Place the gypsum specimens cubes for (7) days in humidity processor, then place it in an oven at temperature of ( $40\pm 5^{\circ}\text{C}$ ) until the weight of the gypsum cubes will constant.
8. Cool the gypsum cubes in room temperature
9. Put the gypsum cubes in compressive machine and apply a constant load (load rate  $(1-3) \text{ kg/cm}^2$ ) on the face perpendicular to the cast face until it fail.

### Calculation:

- The required amount of water is specifying from the consistency test

$$W = \frac{\text{Normal Consistency}}{100} \times G$$

Where:

W: Volume of water in (ml)

G: Weight of gypsum (1000 gm)

- Calculate the compressive strength in (N/mm<sup>2</sup>) from the following equation:

$$\text{Comp. Str.} = \frac{P}{A}$$

Where:

Comp. Str.: Compressive strength in (N/mm<sup>2</sup>)

P: failure load in (N)

A: cross section area in (mm<sup>2</sup>)

**Note:** Take an average of three cubes for calculation the compressive strength.

### Specification Limits:

Iraqi standard specification No. 28 specifies the max. limits of compressive strength for each type of gypsum as shown below:

مقاومة الانضغاط (نت/ملم <sup>2</sup> )	نوع الجص
3	الجص الاعتيادي
5	البورك
6	الجص الفني

### Discussion:

1. What is the compressive strength of gypsum specimens for this test?
2. Compare the results with the Iraqi standard specification No. 28?
3. What are the dimensions of the compressive strength molds?
4. How is the gypsum specimens storage before test?
5. How can we remove the bubbles from the gypsum paste?

## Modulus of Rupture Test معاير الكسر لعجينة الجص 5.3

### Objective:

Specify the modulus of rupture of gypsum specimens.

### Standard Specification:

The Iraqi standard specifications adopted in this test were:

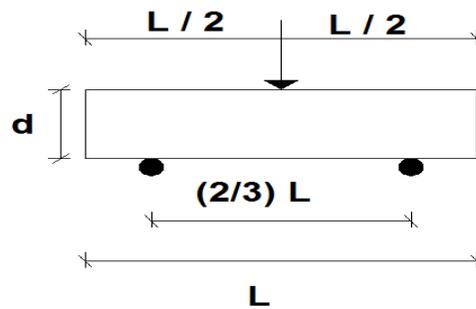
- Iraqi standard specification No. 27 /1985 (IQS 27-1985)

### Apparatus:

- Specimen's molds of (40x40x160) mm made of non-corrodible material for flexural strength test.
- Accurate balance
- Oil
- Knife
- Mixing bowl (clean and dry)

### Procedure:

1. Applying a thin layer of suitable oil to the cast mold
2. Prepare a gypsum pate according to the previous tests (Take 1000 gm of gypsum)
3. Add the gypsum paste into the prism mold in two layers, each layer (20mm) in height
4. Scrolling the gypsum paste with the knife gently for (5) times to remove the bubbles for each of two layers
5. Flat the surface with knife
6. After the gypsum specimens were hardened, it will remove from the mold
7. Place the gypsum specimens cubes for (7) days in humidity processor, then place it in an oven at temperature of (40±5°C) until the weight of the gypsum cubes will constant.
8. Cool the gypsum cubes in room temperature
9. Put the gypsum prism in flexural machine (using one point load method) and apply the load on the face perpendicular to the cast face until it fail.



**Calculation:**

- The required amount of water is specifying from the consistency test

$$W = \frac{\text{Normal Consistency}}{100} \times G$$

Where:

**W:** Volume of water in (ml)

**G:** Weight of gypsum (1000 gm)

- Calculate the modulus of rupture in ( $\text{N}/\text{mm}^2$ ) from the following equation:

$$\text{M. O. R} = \frac{3PL}{2b d^2}$$

Where:

**M.O.R:** modulus of rupture in ( $\text{N}/\text{mm}^2$ )

**P:** failure load in (N)

**L:** length in (mm)

**b:** width in (mm)

**d:** thickness in (mm)

**Note:** Take an average of three prisms for calculation the modulus of rupture.

### **Specification Limits:**

**Iraqi standard specification No. 28 specifies the max. limits modulus of rupture for each type of gypsum as shown below:**

مقاومة الانثناء (نت/ملم <sup>2</sup> )	نوع الجص
-	الجص الاعتيادي
1.5	البورك
2	الجص الفني

### **Discussion:**

- 1. What is the modulus of rupture of gypsum specimens for this test?**
- 2. Compare the results with the Iraqi standard specification No. 28?**
- 3. What are the dimensions of the modulus of rupture molds?**