

Name of Post:	Assistant Manager (Electrical, Mechanical & Civil) in Assam Electricity Grid Corporation Limited (AEGCL)
Advt. No.	13/2023 dated 28.04.2023
Date of Screening Test	18.11.2023

AM/AEGCL/CE/23

BE ASKED TO DO SO

Test Booklet No. :

Series

01004

**TEST BOOKLET
Paper—II
(CIVIL ENGINEERING)**



Time Allowed : 2 Hours

Full Marks : 100

Read the following instructions carefully before you begin to answer the questions :

- The name of the Subject, Roll Number as mentioned in the Admission Certificate, Test Booklet No. and Series are to be written legibly and correctly in the space provided on the Answer-Sheet with Black/Blue ballpoint pen.
- Answer-Sheet without marking Series as mentioned above in the space provided for in the Answer-Sheet shall not be evaluated.**
- All questions carry equal marks.

The Answer-Sheet should be submitted to the Invigilator.

Directions for giving the answers : Directions for answering questions have already been issued to the respective candidates in the 'Instructions for marking in the OMR Answer-Sheet' along with the Admit Card and Specimen Copy of the OMR Answer-Sheet.

Example :

Suppose the following question is asked :

The capital of Bangladesh is

- Chennai
- London
- Dhaka
- Dhubri

You will have four alternatives in the Answer-Sheet for your response corresponding to each question of the Test Booklet as below :



In the above illustration, if your chosen response is alternative (C), i.e., Dhaka, then the same should be marked on the Answer-Sheet by blackening the relevant circle with a Black/Blue ballpoint pen only as below :



The example shown above is the only correct method of answering.

- Use of eraser, blade, chemical whitener fluid to rectify any response is prohibited.
- Please ensure that the Test Booklet has the required number of pages (16) and 100 questions immediately after opening the Booklet. In case of any discrepancy, please report the same to the Invigilator.
- No candidate shall be admitted to the Examination Hall/Room 20 minutes after the commencement of the examination.
- No candidate shall leave the Examination Hall/Room without prior permission of the Supervisor/Invigilator.** No candidate shall be permitted to hand over his/her Answer-Sheet and leave the Examination Hall/Room before expiry of the full time allotted for each paper.
- No Mobile Phone, Electronic Communication Device, etc., are allowed to be carried inside the Examination Hall/Room by the candidates. Any Mobile Phone, Electronic Communication Device, etc., found in possession of the candidate inside the Examination Hall/Room, even if on off mode, shall be liable for confiscation.
- No candidate shall have in his/her possession inside the Examination Hall/Room any book, notebook or loose paper, except his/her Admission Certificate and other connected papers permitted by the Commission.
- Complete silence must be observed in the Examination Hall/Room. No candidate shall copy from the paper of any other candidate, or permit his/her own paper to be copied, or give, or attempt to give, or obtain, or attempt to obtain irregular assistance of any kind.
- This Test Booklet can be carried with you after answering the questions in the prescribed Answer-Sheet.
- Noncompliance with any of the above instructions will render a candidate liable to penalty as may be deemed fit.
- No rough work is to be done on the OMR Answer-Sheet. You can do the rough work on the space provided in the Test Booklet.

N.B. : There will be negative marking @ 0.25 per 1 (one) mark against each wrong answer.

/14-D

[No. of Questions : 100]

SEAL

1. In LSM, $x_{u\max}/d$ for Fe 500 is

- (A) 0.48
- (B) 0.36
- (C) 0.53
- (D) 0.46

2. In an eccentric connection, when the connecting plates are parallel, bolts undergo

- (A) shear and moment
- (B) shear and tension
- (C) tension and torsion
- (D) shear and fatigue

3. The effective length for a column, which is effectively held in position at both ends and restrained against rotation at one end only, is given by

- (A) $1.00L$
- (B) $2.00L$
- (C) $0.65L$
- (D) $0.80L$

4. Torsional reinforcement provided at discontinuous corners of rectangular slab panels extends over a distance of not less than

- (A) one-fourth of shorter span
- (B) one-third of shorter span
- (C) one-fifth of shorter span
- (D) None of the above

5. Under factored loads, the limiting bearing stress, $f_{br, \max}$ at column footing interface is

- (A) $0.45 f_{ck} \sqrt{\frac{A_1}{A_2}}$
- (B) $0.50 f_{ck} \sqrt{\frac{A_1}{A_2}}$
- (C) $0.45 f_{ck}$
- (D) $0.55 f_{ck}$

6. Identify the correct statement from the following.

- (A) Residual soils remain at the place of their formation.
- (B) Transported soils are found at locations away from their place of formation.
- (C) Loam is a mixture of sand, silt and clay.
- (D) All of the above

7. For sandy silt, the void ratio and the specific gravity of the soil solids are given as 0.80 and 2.67 respectively. The value of critical hydraulic gradient is

- (A) 0.35
- (B) 0.93
- (C) 1.13
- (D) 3.34

8. The void ratio of a soil sample is given as 0.645. The porosity of the soil sample would be

- (A) 0.392
- (B) 1.645
- (C) 0.645
- (D) 1.55

9. The minimum depth of soil exploration below a square footing shall be at least
- twice the width of footing
 - thrice the width of footing
 - four times the width of footing
 - 1.5 times the width of footing
10. A sand deposit contains two distinct horizontal layers of equal thickness. The hydraulic conductivity of the top layer is 10^{-3} cm/s and that of the bottom layer is 10^{-2} cm/s. The equivalent horizontal conductivity of the sand deposit is
- 10^{-5} cm/s
 - 5.5×10^{-3} cm/s
 - 10^{-1} cm/s
 - 3.2×10^{-3} cm/s
11. The relationship between water content ($w\%$) and number of blows (N) in soils as obtained from Casagrande's liquid limit apparatus is given by $w = 20 - \log_{10} N$. The liquid limit of the soil is
- 15.6%
 - 16.6%
 - 17.6%
 - 18.6%
12. The saturated unit weight of sand in the bed of a pond 20 m deep is 20 kN/m^3 . The unit weight of water is 10 kN/m^3 . The effective stress at 4 m below the bed level of the pond is
- 40 kN/m^2
 - 20 kN/m^2
 - 60 kN/m^2
 - 80 kN/m^2
13. A retaining wall with a vertical back of height 7.32 m supports a cohesionless soil of unit weight 17.3 kN/m^3 and an angle of shearing resistance of 30° . The surface is horizontal. The magnitude of the active thrust per metre of the wall is
- 7.32 kN/m
 - 154.5 kN/m
 - 17.3 kN/m
 - 51.9 kN/m
14. Vane shear test is used to determine the undrained strength of fully saturated
- clays
 - sands
 - gravels
 - All of the above
15. When a loose saturated sand deposit is subjected to a shock or dynamic load, its shear strength will
- increase
 - decrease
 - remain same
 - increase or decrease depending on applied load
16. Influence factor for immediate settlement of footing depends on its
- size and shape
 - rigidity alone
 - location and size
 - size, shape, rigidity and location

17. In under-reamed pile construction, the ratio of bulb diameter to shaft diameter is

- (A) 2
- (B) 4
- (C) 2.5
- (D) 1

18. The load-carrying capacity of an individual friction pile is 250 kN. The total load-carrying capacity of a group of such piles with group efficiency factor of 0.78 will be

- (A) 1100 kN
- (B) 1560 kN
- (C) 780 kN
- (D) 1000 kN

19. Vibroflotation is best suited for compacting

- (A) coarse sand and gravels
- (B) silts
- (C) organic soils
- (D) clay soils

20. Triaxial test is generally done for

- (A) unconsolidated-undrained test
- (B) consolidated-undrained test
- (C) consolidated-drained test
- (D) All of the above

21. A stratum of clay 2.0 m thick got 80% consolidation in 10 years. For 80% consolidation (with same drainage conditions) of 8.0 m thick stratum of the same clay, the time requirement shall be

- (A) 100 years
- (B) 120 years
- (C) 160 years
- (D) 40 years

22. Which of the following statements is incorrect with regard to Terzaghi's one-dimensional consolidation theory?

- (A) Soil is homogeneous and fully saturated.
- (B) Darcy's law is valid.
- (C) Flow of both water and soil particles is in one direction only.
- (D) Both water and soil particles are compressible.

23. Pick up the correct statement from the following with regard to negative skin friction in piles.

- (A) Negative skin friction decreases the capacity of a single pile or a pile group.
- (B) Negative skin friction increases the capacity of piles.
- (C) Negative skin friction does not have any effect on the capacity of piles.
- (D) None of the above

24. The viscosity μ of a fluid is primarily a function of

- (A) density
- (B) temperature
- (C) pressure
- (D) velocity

25. U-tube differential manometers are used to measure

- (A) absolute pressure at a point
- (B) local atmospheric pressure
- (C) difference in total energy between two points
- (D) difference in pressure between two points

26. If a solid body weighs 50.0 N in air and 30.0 N in water, the specific gravity of the material of the body is

- (A) 1.60
- (B) 1.67
- (C) 2.50
- (D) 3.00

27. A tank of water has a 5.0 m high and 3.0 m wide gate in its vertical wall. The top edge of the gate is 2.0 m below the water surface. The hydrostatic force acting on the gate is

- (A) 662 kN
- (B) 147 kN
- (C) 490 kN
- (D) 367 kN

28. A streamline and an equipotential line in the flow field

- (A) are parallel to each other
- (B) are perpendicular to each other
- (C) intersect at an acute angle
- (D) are identical

29. For a two-dimensional flow field, the stream function ψ is given as

$$\psi = \frac{3}{2}(y^2 - x^2)$$

The magnitude of discharge occurring between the streamlines passing through the points (0, 3) and (3, 4) is

- (A) 6 units
- (B) 3 units
- (C) 1.5 units
- (D) 2 units

30. The minor losses through valves, fittings, bends, etc., in a pipeline are commonly modelled as proportional to

- (A) velocity head
- (B) static head
- (C) total head
- (D) pressure drop

31. In flow through a straight, smooth pipe, the Reynolds number for transition to turbulence is generally taken as

- (A) 1500
- (B) 2000
- (C) 500
- (D) 4000

32. A 3.0 cm diameter water jet produces a force of 23.0 N, when it strikes a stationary plate held perpendicular to the jet. The average velocity of the jet of water is
- (A) 2.85 m/s
 (B) 8.10 m/s
 (C) 5.70 m/s
 (D) 2.30 m/s
33. A rectangular channel 3.0 m wide is laid on a small slope. If the water depth is 2.0 m, the hydraulic radius is
- (A) 0.43 m
 (B) 0.60 m
 (C) 0.86 m
 (D) 1.00 m
34. A rectangular channel of 4.0 m width conveys water at $8.0 \text{ m}^3/\text{s}$ under critical condition. The specific energy for this flow is
- (A) 1.112 m
 (B) 0.742 m
 (C) 1.488 m
 (D) 0.370 m
35. The dimensional formula of Chezy's coefficient C is
- (A) LT^{-1}
 (B) LT^2
 (C) LT^{-2}
 (D) $L^{1/2}T^{-1}$
36. The hydraulic radius for a hydraulically efficient rectangular channel section having a flow depth of y is
- (A) y
 (B) $\frac{y}{2}$
 (C) $\frac{y}{2\sqrt{2}}$
 (D) y^2
37. A hydraulic jump occurs when
- (A) a subcritical flow changes to supercritical flow
 (B) a supercritical flow changes to critical flow
 (C) a critical flow changes to supercritical flow
 (D) a supercritical flow changes to subcritical flow
38. The dimensional formula of coefficient of dynamic viscosity in MLT system is
- (A) $ML^{-1}T$
 (B) $M^{-1}L^{-1}T^{-1}$
 (C) $ML^{-1}T^{-1}$
 (D) MLT^{-1}
39. The depth of flow in an alluvial channel is 1.5 m. If the critical velocity ratio is 1.1 and Manning's n is 0.018, the critical velocity in the channel as per Kennedy's method is
- (A) 0.713 m/s
 (B) 0.784 m/s
 (C) 0.879 m/s
 (D) 1.108 m/s

40. The ratio of actual evapo-transpiration to potential evapo-transpiration is in the range of
- (A) 0.0 to 0.4
 (B) 0.6 to 0.9
 (C) 0.0 to 1.0
 (D) 1.0 to 2.0
41. The relationship among porosity (η), specific yield (S_y) and specific retention (S_r) of an unconfined aquifer is
- (A) $S_y + S_r = \eta$
 (B) $S_y + \eta = S_r$
 (C) $S_r + \eta = S_y$
 (D) $S_y + S_r + \eta = 1$
42. In a syphon aqueduct, the most severe condition of uplift on the floor occurs when
- (A) the canal and drainage run full
 (B) the canal runs full, the drainage is dry and the water table is at the streambed
 (C) the canal is dry, the drainage flow is at HFL and the water table is at the HFL of the drainage flow
 (D) the canal runs full and the drainage is dry
43. When a canal is passed under the drainage such that the full supply level of the canal does not touch the underside of the supporting structure, the cross-drainage work is called
- (A) superpassage
 (B) spillway
 (C) syphon aqueduct
 (D) aqueduct
44. Water emerges from an ogee spillway with velocity of 13.72 m/s and depth of 0.3 m at its toe. The tail water depth required to form a hydraulic jump at the toe is
- (A) 6.48 m
 (B) 5.24 m
 (C) 2.24 m
 (D) 3.24 m
45. The most important water quality parameter for domestic use of water is
- (A) carbonate hardness
 (B) non-carbonate hardness
 (C) coliform group of organisms
 (D) chlorides
46. Excessive fluoride in drinking water causes
- (A) Alzheimer disease
 (B) melting of teeth and embrittlement of bones
 (C) methemoglobinemia
 (D) skin cancer

47. 1 TCU is equivalent to the colour produced by
- (A) 1 mg/L of chloroplatinate ion
 - (B) 1 mg/L of platinum ion
 - (C) 1 mg/L of platinum in the form of chloroplatinate ion
 - (D) 1 mg/L of organochloroplatinate ion
48. The absorbent most commonly used in water and wastewater treatment is
- (A) sand of grain size from 0.1 mm to 2.0 mm
 - (B) activated carbon granules of size 0.1 mm to 2.0 mm
 - (C) ordinary wood shavings of fine size
 - (D) stone dust
49. The most common coagulant used for water purification is
- (A) ammonium chloride
 - (B) aluminium chloride
 - (C) copper sulphate
 - (D) aluminium sulphate
50. An inverted syphon is a
- (A) device for distributing septic tank effluent to a soil absorption system
 - (B) device for preventing overflow from elevated water storage tank
 - (C) device for preventing crown corrosion of sewer
 - (D) section of sewer which is dropped below the hydraulic grade line in order to avoid an obstacle
51. A rapid test to indicate the intensity of pollution in river water is
- (A) dissolved oxygen
 - (B) biochemical oxygen demand
 - (C) MPN
 - (D) total dissolved solids
52. The standard 5-day BOD of a wastewater sample is nearly $x\%$ of the ultimate BOD, where x is
- (A) 48
 - (B) 58
 - (C) 68
 - (D) 78
53. Trickling filter is designed to remove
- (A) settleable solids
 - (B) colloidal solids
 - (C) dissolved organic matter
 - (D) None of the above
54. Activated sludge is the
- (A) aerated sludge in the aeration unit
 - (B) sludge settled in the humus tank
 - (C) sludge in the secondary tank after aeration and rich in nutrients
 - (D) sludge in the secondary tank after aeration and rich in microbial masses

55. Particulate matter (fly ash) carried in effluent gases from the furnaces burning fossil fuels is better removed by
- cotton baghouse filter
 - electrostatic precipitator
 - cyclone
 - wet scrubber
56. Transition curve is provided in horizontal alignment
- to increase the radius of curvature
 - to facilitate the application of superelevation
 - to counteract the centrifugal force developed
 - to prevent vehicle from skidding laterally
57. The important factor considered in the design of summit curves on highway is
- comfort to passenger
 - sight distance
 - superelevation
 - impact factor
58. The superelevation needed for a vehicle travelling at a speed of 60 kmph on a curve of radius 128 m on a surface with a coefficient of friction of 0.15 is
- 0.071
 - 0.015
 - 0.022
 - 0.22
59. The star and grid pattern of road network was adopted in
- Nagpur Road Plan
 - Lucknow Road Plan
 - Delhi Road Plan
 - Bombay Road Plan
60. The coefficient of friction in the longitudinal direction of a highway is estimated as 0.396. The braking distance for a car moving at a speed of 65 kmph is
- 87 m
 - 45 m
 - 42 m
 - 40 m
61. The PCU (passenger car unit) for car on an urban road is
- 0.5
 - 1.0
 - 3.0
 - 4.0
62. The speed and delay studies on a defined section of highway are conducted by
- radar gun
 - traffic counters
 - enoscope
 - moving car method

63. The result of ring and ball softening point test on asphalts is given in terms of
- viscosity
 - time
 - flow
 - temperature
64. Aggregate impact value indicates which of the following properties of aggregate?
- Toughness
 - Durability
 - Hardness
 - Strength
65. The modulus of subgrade reaction is evaluated from
- plate load test
 - CBR test
 - direct shear test
 - triaxial test
66. For broad-gauge railway track on a horizontal curve of radius R (in metre), the equilibrium cant e required for the train moving at a speed V (in kmph) is
- $1.676 \frac{V^2}{R}$
 - $1.35 \frac{V^2}{R}$
 - $1.315 \frac{V^2}{R}$
 - $0.80 \frac{V^2}{R}$
67. 1.0 cm on a topographical map represents 2.5 km on the ground. The representative fraction (RF) used in this case is
- 1 in 25000
 - 1 in 250000
 - 1 in 2500
 - 1 in 250
68. The area of a rectangular field, measured using a 30 m chain, was found to be 45.0 km^2 . It was afterwards found that the chain used for the purpose was 0.1 m too short. The true area of the field is
- 45.30 km^2
 - 44.70 km^2
 - 45.10 km^2
 - 44.90 km^2
69. Which of the following is used in measuring angles on slopes?
- Clinometer
 - Odometer
 - Pedometer
 - Passometer

70. The bearings of lines AB and BC in WCB system are given as $146^{\circ}12'$ and $68^{\circ}24'$ respectively. The angle between the lines AB and BC is
- $326^{\circ}12'$
 - $68^{\circ}24'$
 - $102^{\circ}12'$
 - $77^{\circ}38'$
71. The magnetic bearing of a line AB is $134^{\circ}45'$, while the true bearing is $130^{\circ}15'$. The magnetic declination is
- $4^{\circ}30'$ E
 - S $4^{\circ}30'$ W
 - N $4^{\circ}30'$ E
 - $4^{\circ}30'$ W
72. The length and the bearing of a line AB are given as 100.0 m and 150° respectively. The latitude and departure of the line are
- 86.6 southing and 50.0 easting
 - 86.6 northing and 50.0 easting
 - 50.0 northing and 86.6 easting
 - 86.6 northing and 50.0 westing
73. The correction for refraction in levelling for a distance of 1.5 km would be approximately
- 0.004 m
 - 40 cm
 - 0.025 m
 - 2.5 m
74. The rise and fall method provides an arithmetic check on
- backsights and foresights
 - intermediate sights
 - backsights and intermediate sights
 - backsights, intermediate sights and foresights
75. The method of orientation used, when the plane table occupies a position not yet located on the map, is called
- traversing
 - radiation
 - levelling
 - resection
76. Optimal flight planning for a photogrammetric survey should be carried out considering
- only side-lap
 - only end-lap
 - both side-lap and end-lap
 - either side-lap or end-lap
77. The number of spectral bands in the enhanced thematic mapper sensor on the remote sensing satellite Landsat 7 is
- 64
 - 8
 - 10
 - 15

78. The equations of equilibrium for non-concurrent coplanar force systems are
- (A) $\Sigma F_x = 0, \Sigma F_y = 0, \Sigma M \neq 0$
- (B) $\Sigma F_x = 0, \Sigma F_y = 0, \Sigma M = 0$
- (C) $\Sigma F_x = 0, \Sigma F_y = 0, \Sigma M_{xy} \neq 0$
- (D) None of the above
79. The intensity of stress which causes unit strain is called
- (A) unit stress
- (B) modulus of rigidity
- (C) bulk modulus
- (D) modulus of elasticity
80. The moment of inertia of a triangular section about an axis passing through the CG and parallel to the base, where b is the base and h is the height of the triangle, is
- (A) $bh^3/12$
- (B) $bh^3/36$
- (C) $bh^3/48$
- (D) $bh^3/3$
81. The Poisson's ratio is defined as
- (A) axial stress divided by lateral stress
- (B) lateral strain divided by axial strain
- (C) lateral stress divided by axial stress
- (D) axial strain divided by lateral strain
82. According to parallel axis theorem, the moment of inertia (I_P) of a section about an axis parallel to the axis through the centre of gravity is given by (where A = area of the section, I_G = moment of inertia of the section about an axis passing through its CG and h = distance between CG and the parallel axis)
- (A) $I_P = I_G - Ah^2$
- (B) $I_P = I_G + Ah^2$
- (C) $I_P = Ah^2 / I_G$
- (D) $I_P = I_G / (Ah^2)$
83. Euler's formula holds good for
- (A) long columns
- (B) short columns
- (C) strong columns
- (D) weak columns
84. The effective length of a column of length L fixed against rotation and translation at one end and free at the other end is
- (A) $0.5L$
- (B) $0.7L$
- (C) $1.414L$
- (D) $2L$
85. The radius of gyration is
- (A) $r = \sqrt{\frac{I}{A}}$
- (B) $r = \sqrt{\frac{I}{EA}}$
- (C) $r = \sqrt{\frac{M}{EI}}$
- (D) None of the above

86. A steel wire of 10 mm diameter is bent into a circular arc of 20 m radius. If $E = 2 \times 10^5$ N/mm², the maximum stress induced is

(A) 100 N/mm²

(B) 25 N/mm²

(C) 55 N/mm²

(D) 50 N/mm²

87. Considering shear stress distribution over solid circular section, the relationship between mean shear stress (q_{mean}) and maximum shear stress (q_{max}) is

(A) $q_{\text{max}} = \frac{4}{3} q_{\text{mean}}$

(B) $q_{\text{max}} = \frac{3}{2} q_{\text{mean}}$

(C) $q_{\text{max}} = \frac{7}{3} q_{\text{mean}}$

(D) $q_{\text{max}} = \frac{3}{4} q_{\text{mean}}$

88. A rectangular bar of width b and height h is used as a cantilever. The loading is in a plane parallel to the side b . The section modulus is

(A) $bh^3/12$

(B) $bh^2/6$

(C) $b^2h/6$

(D) $b^3h/6$

89. Tensile strength of a material is obtained by dividing the maximum load during the test by the

(A) area at the time of fracture

(B) minimum area after fracture

(C) original cross-sectional area

(D) average of (A) and (C)

90. The point of contraflexure is a point where

(A) bending moment changes sign

(B) shear force changes sign

(C) shear force is maximum

(D) bending moment is maximum

91. A uniformly distributed live load of 60 kN/m run of length 5 m moves on a girder of span 16 m. The maximum positive shear force at a section 6 m from left end is

(A) 65.625 kN

(B) 150.025 kN

(C) 120.625 kN

(D) 140.625 kN

92. The degree of external redundancy is defined as (where R is total number of reaction components, r is total number of condition equations, m is total number of members and j is total number of joints)

(A) $E = R - r$

(B) $E = R + r$

(C) $E = m - 2j + r$

(D) $E = 2j - 3$

93. A truss formed by connecting two or more simple trusses together either by hinge or by additional members is called
- complex truss
 - space truss
 - compound truss
 - three-dimensional truss
94. A torque which can be safely transmitted by a shaft of 200 mm diameter (shear stress not to exceed 50 N/mm^2) is
- 78.54 kN-m
 - 50.00 kN-m
 - 50.00 kN
 - 78.54 kN
95. In moment distribution method, distribution factors depend upon
- moment of inertia of members only
 - relative stiffness
 - rotation factor
 - None of the above
96. Find out the wrong statement.
- Cable is a tension member.
 - Generally arch is a compression member.
 - Bending moment in a cable is zero everywhere.
 - Bending moment in a cable is non-zero everywhere.
97. In a two-hinged arch, an increase in temperature induces
- no bending moment in the arch rib
 - uniform bending moment in the arch rib
 - maximum bending moment at the crown
 - minimum bending moment at the crown
98. Mechanical properties of steel do not depend upon
- chemical composition
 - rolling methods and heat treatment
 - shape of the section
 - stress history
99. The structural steel section most suited as flexural member is
- channel section
 - beam section
 - angle section
 - tee section
100. In Concrete Technology, SMF, SNF and MLS are
- different types of plasticizers
 - different types of cement
 - different types of aggregates
 - different types of super-plasticizers

SPACE FOR ROUGH WORK

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SEAL

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