BASF
The Chemical Company

Note to Specifier:

The **Admixture Systems** business of **BASF's Construction Chemicals Division** previously conducted business as **Degussa Admixtures, Inc.** and **Master Builders, Inc.**

The Master Builders brand of innovative chemical admixtures and solutions that have been used in concrete for over a century are now offered by **BASF – The Chemical Company**, the largest chemical company in the world.

Please update your Master Specifications to reflect the company name change.

For a MS Word version of this specification, please send an email to admixtures@basf.com

Options and notes are provided in square brackets. Delete those that are not necessary.

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Materials and procedures for Cast-in-Place Concrete.

1.2 RELATED SECTIONS

A. Related Sections:

1. Section 01 10 00 - Summary
2. Section 01 33 00 - Submittal Procedures
3. Section 01 45 00 - Quality Control
4. Section 01 60 00 - Product Requirements
5. Section 03 01 30 - Maintenance of Cast-in-Place Concrete
6. Section 03 10 00 - Concrete Forming and Accessories
7. Section 03 20 00 - Concrete Reinforcing
8. Section 03 35 00 - Concrete Finishing

Master Builders

9. Section 03 39 00 - Concrete Curing
10. Section 07 92 00 - Joint Sealants

1.3 REFERENCES

A. ASTM International (ASTM):

1. A 820/A 820M - Standard Specification for Steel Fibers for Fiber-Reinforced Concrete
2. C 31/C 31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field
3. C 33 - Standard Specification for Concrete Aggregates
4. C 39/C 39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
5. C 94/C 94M - Standard Specification for Ready-Mixed Concrete
6. C 138/C 138M - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete
7. C 143/C 143M - Standard Test Method for Slump of Hydraulic Cement Concrete
8. C 150 - Standard Specification for Portland Cement
9. C 172 - Standard Practice for Sampling Freshly Mixed Concrete
10. C 173/C 173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
11. C 231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
12. C 260 - Standard Specification for Air-Entraining Admixtures for Concrete
13. C 494/C 494M - Standard Specification for Chemical Admixtures for Concrete
14. C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
15. C 989 - Standard Specification for Slag Cement for Use in Concrete and Mortars
16. C 1017/C 1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete
17. C 1064/C 1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
18. C 1116/C 1116M - Standard Specification for Fiber-Reinforced Concrete
19. C 1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures

20. C 1582/C 1582M - Standard Specification for Admixtures to Inhibit Chloride-Induced Corrosion of Reinforcing Steel in Concrete
21. ASTM C 1585 - Standard Test Method for Measurement of Rate of Absorption of Water by Hydraulic-Cement Concretes
22. C 1602/C 1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete
23. E 329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing
24. ASTM F 1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride

B. American Concrete Institute (ACI):

1. 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
2. 301 - Specifications for Structural Concrete
3. 301M - Specifications for Structural Concrete (Metric)
4. 305.1 - Specification for Hot Weather Concreting
5. 306.1 - Standard Specification for Cold Weather Concreting
6. 308.1 - Standard Specification for Curing Concrete
7. 318 - Building Code Requirements for Structural Concrete (ACI 318-08) and Commentary
8. 318M - Building Code Requirements for Structural Concrete (ACI 318M-08) and Commentary (metric)

C. NSF International (NSF):

1. NSF/ANSI Standard 61 - Drinking Water System Components

D. DIN (Deutsches Institut Fur Normung, Germany):

1. DIN 1048 Part 5 “Testing Concrete - Testing of hardened concrete (specimens prepared in mould)”

1.4 SUBMITTALS

A. In accordance with 01 33 00.

1. Mixture proportions.
2. Certification: Manufacturer’s certification stating that the products delivered meet or exceed Project Specifications.

3. Product Data.

4. Ready-mixed concrete delivery tickets.

1.5 QUALITY ASSURANCE

A. In accordance with ACI 301 (ACI 301M) for mixing, transportation, placing and consolidation of concrete.

B. In accordance with ACI 305.1 for hot weather concrete placement.

C. In accordance with ACI 306.1 for cold weather concrete placement.

D. In accordance with ACI 308.1 for curing concrete

E. Testing and Inspection Agency Qualifications: Independent agency conforming to the requirements of ASTM E 329.

1. Personnel conducting field tests shall be certified as ACI Concrete Field Testing Technician - Grade I or equivalent
2. Personnel conducting laboratory tests shall be certified as ACI Concrete Laboratory Testing Technician - Grade I or equivalent

1.6 DELIVERY, STORAGE AND HANDLING

A. Ready-mixed concrete truck driver shall provide batch ticket to the Architect/Engineer or his [her] representative in the field at the time of concrete delivery. Contents of the batch ticket shall be as specified in ASTM C 94/C 94M.

PART 2 PRODUCTS

2.1 MATERIALS

A. Portland Cement: Shall conform to ASTM C 150, Type [I] [II] [I/II] [III] [V].

B. Aggregates: Fine and coarse aggregates shall conform to ASTM C 33.

C. Water: Shall conform to ASTM C 1602/C 1602M.

D. Admixtures: Furnish from one manufacturer.

1. Characteristics: Compatible with each other and free of intentionally-added chlorides.

2. Air-Entraining Admixture:
   a. Shall conform to ASTM C 260.
   b. Products and Manufacturers:
      "MB-AE™ 90", "MB-VR™" or "Micro Air®" by BASF Corporation - Admixture Systems.

3. Water-Reducing Admixture:
   a. Shall conform to ASTM C 494/C 494M Type A.
   b. Products and Manufacturers:
      "Pozzolith®" Series by BASF Corporation - Admixture Systems.

4. Mid-Range Water-Reducing Admixture:
   a. Shall conform to ASTM C 494/C 494M Type A.
   b. Products and Manufacturers:
      "PolyHeed®" Series by BASF Corporation - Admixture Systems.

5. High-Range Water-Reducing Admixture:
   a. Shall conform to ASTM C 494/C 494M Type F [or ASTM C 1017/ C 1017M Type I].
   b. Products and Manufacturers:
      "Rheobuild® 1000", "Glenium®" Series or "PS 1466" by BASF Corporation - Admixture Systems.

6. Accelerating Admixture:
   a. Shall conform to ASTM C 494/C 494M Type C or E.
   b. Products and Manufacturers:
      "Pozzolith NC 534" or "Pozzutec® 20+" by BASF Corporation - Admixture Systems.

7. Retarding Admixture:
   a. Shall conform to ASTM C 494/C 494M Type B or D.
   b. Products and Manufacturers:
      "Pozzolith" Series or "DELVO®" Series by BASF Corporation - Admixture Systems.

8. Hydration Control Admixture:
   a. Shall conform to ASTM C 494/C 494M Type B or D.
   b. Products and Manufacturers:
      "DELVO" Series by BASF Corporation - Admixture Systems.

9. Workability-Retaining Admixture:
   a. Shall retain concrete workability without affecting time of setting or early-age strength development.
   b. Shall conform to ASTM C 494/C 494M Type S.
   c. Products and Manufacturers:
      "RheoTEC™ Z-60" by BASF Corporation - Admixture Systems.

10. Waterproofing Admixture:

    a. Shall be an integral crystalline capillary waterproofing admixture for concrete.
    b. Shall satisfy the following requirements, when used at the manufacturer's recommended dosage:
        i. Reduction in capillary absorption: Not less than 40 percent relative to a companion untreated concrete mixture, when tested in accordance with ASTM C 1585.
        ii. Reduction in water penetration: Not less than 40 percent relative to a companion untreated concrete mixture, when tested in accordance with DIN 1048.
        iii. The admixture shall not affect the setting time, strength or durability properties of concrete.
    c. Shall be certified to NSF/ANSI 61.

    [Note: NSF Certification may be required for potable water tanks. Delete if it is not required for the project.]

    d. Product:
    "Rheomac 300D" by BASF Corporation - Admixture Systems.

11. Corrosion-Inhibiting Admixture:

    a. Shall conform to ASTM C 1582/C 1582M.
    b. Products and Manufacturers:
    "Rheocrete® CNI" or "Rheocrete 222+" by BASF Corporation - Admixture Systems.

12. Shrinkage-Reducing Admixture:

    a. Products and Manufacturers:
    "Tetraguard® AS20" by BASF Corporation - Admixture Systems.

13. Alkali-Silica Reaction Inhibiting Admixture:

    a. Shall contain a nominal lithium nitrate content of 30 percent.
    b. Products and Manufacturers:
    "ASRx™ 30 LN" by BASF Corporation - Admixture Systems.

14. Coloring Admixture:

    a. Products and Manufacturers:
    "RHEOCOLOR® L" by BASF Corporation - Admixture Systems.

15. Other admixtures shall be approved by the Architect/Engineer.

E. Supplementary Cementitious Materials (SCM):

1. The substitution of supplementary cementitious materials for cement shall be made on the basis of mass.

2. Fly Ash: Shall conform to ASTM C 618.

3. Slag Cement: Shall conform to ASTM C 989.

4. Silica Fume: Shall conform to ASTM C 1240.

   a. Products and Manufacturers:
   "Rheomac® SF 100" by BASF Corporation - Admixture Systems.

F. Fibers:

1. Microsynthetic Fibers:

   a. Shall conform to ASTM C 1116/C 1116M.

   b. Products and Manufacturers:
   "MasterFiber™ F or M" Series by BASF Corporation - Admixture Systems.

2. Macrosynthetic Fibers:

   a. Shall conform to ASTM C 1116/C 1116M.

   b. Products and Manufacturers:
   "MasterFiber MAC" Series by BASF Corporation - Admixture Systems.

3. Steel Fibers:

   a. Shall conform to ASTM A 820/A 820M.

   b. Products and Manufacturers:
   "MasterFiber FF or FS" Series by BASF Corporation – Admixture Systems.

G. Evaporation Reducer:

1. Shall be a monomolecular film-forming liquid for application to fresh concrete to prevent rapid drying of the surface.

   a. Products and Manufacturers:
   "Confilm®" by BASF Corporation - Admixture Systems.

2. Evaporation reducer shall not be used as a finishing aid.

H. Curing Materials: Shall be in accordance with Section 03 39 00.

2.2 CONCRETE MIXTURES

A. Mixture Specifications:

1. Water-to-cementitious materials ratio shall not exceed [0.40] [0.45] [0.50] [ ] by mass.

2. Supplementary Cementitious Materials: The mass of SCM shall not exceed the percentages listed in the following table for concrete exposed to deicing chemicals.

Material	Maximum percent of SCM by mass of total cementitious materials
Fly ash or other pozzolans	25
Slag cement	50
Silica Fume	10
Total of Fly ash or other pozzolans, slag cement and silica fume	50*
Total of fly ash or other pozzolans and silica fume	35*

* Fly ash or other pozzolans and silica fume shall not constitute more than 25 and 10 percent, respectively, of the total mass of cementitious material

B. Slump:

1. Slump shall be [4±1-inch (100± 25 mm)] [8±11/2-inch (200 ± 40 mm)] [___ inch (___ mm)].

C. Specified compressive strength: [3000 psi (20 MPa)] [4000 psi (27.5 MPa)] [5000 psi (35 MPa)] [___ psi (___ MPa)] at 28 days.

[*Note: ACI 318 [ACI 318M] has the following recommendations:*

Since it is difficult to accurately determine the water-cementitious materials ratio of concrete during production, the compressive strength specified should be reasonably consistent with the water-cementitious materials ratio required for durability. Selection of a compressive strength that is consistent with the water-cementitious materials ratio selected for durability will help ensure that the required water-cementitious materials ratio is actually obtained in the field. Because the usual emphasis on inspection is for strength, test results substantially higher than the specified strength may lead to a lack of concern for quality and production of concrete that exceeds the maximum water-cementitious material ratio. (See Section R4.1.1 of ACI 318-08 [ACI 318M-08] for details)]

D. Maximum nominal size of coarse aggregate:

1. Not larger than 1/5 the narrowest dimension between sides of forms.
2. Not larger than 1/3 the depth of slabs.
3. Not larger than 3/4 of the minimum clear spacing between individual reinforcing bars or wires, bundles of bars, individual tendons, bundled tendons, or ducts.

   [*Note: These limitations shall not apply if, in the judgment of the Architect/Engineer, workability and methods of consolidation are such that concrete can be placed without honeycombs or voids*].

4. [Maximum size of aggregate shall be [3/4-inch (19 mm)] [1-inch (25 mm)] [1 1/2-inch (38 mm)]]

E. Air content shall be [less than 3%] [5-7%] [___ %].

F. Furnish to the Architect/Engineer a mixture proportion for the concrete to be used.

1. Proportion the mixtures based on ACI 318 (ACI 318M) [ACI 301 (ACI 301M)] [ACI 211.1].

2. Use the same components in the trial batches as that to be used in the project including coarse and fine aggregates, water, source and type of cement, supplementary cementitious materials and admixtures including any site-added admixtures intended to be used.

PART 3 EXECUTION

3.1 FORMWORK

A. Concrete formwork shall be in accordance with Section 03 10 00.

3.2 BATCHING

A. Materials shall be batched in accordance with ASTM C 94/C 94M.

3.3 TRANSPORTING

A. Concrete shall be transported in accordance with ASTM C 94/C 94M.

3.4 PLACING

A. Concrete shall not be placed until all formwork, reinforcement, installation of parts to be embedded, bracing of forms, and preparation of surfaces involved in the placing have been reviewed and approved by the Architect/Engineer.

B. Concrete shall be placed in accordance with ACI 301 (ACI 301M).

3.5 COLD WEATHER CONCRETING

A. Concrete shall be placed and protected in accordance with ACI 306.1.

3.6 HOT WEATHER CONCRETING

A. Concrete shall be placed and protected in accordance with ACI 305.1.

3.7 FIELD QUALITY CONTROL

A. General:

1. Provide concrete for testing of slump, air content, density (unit weight) and temperature and, for making cylinders.
2. Provide adequate facilities for safe storage and proper curing of concrete test cylinders onsite for the first 24 hours or for additional time as may be required before transporting samples to the test lab.

B. Field addition of admixtures, if needed for logistics reasons, shall be approved by the Architect/Engineer.

C. Field testing and inspection shall be performed in accordance with ACI 301 (ACI 301M) by a qualified testing agency.

D. Tests shall be conducted on the first batch of the day and for each 100 yd^3 (76 m^3) or fraction thereof, for each concrete mixture placed in any one day**.**

E. The testing agency shall provide the following services:

1. Inspect concrete placement.
2. Sample the concrete in accordance with ASTM C 172.
3. Test concrete slump in accordance with ASTM C 143/C 143M.
4. Determine the air content of concrete sample for each strength test in accordance with ASTM C 231 or ASTM C 173/C 173M.
5. Determine the density (unit weight) of concrete sample for each strength test in accordance with ASTM C 138/ C 138M.
6. Record the temperature of concrete for each strength test in accordance with ASTM C 1064/C 1064M.
7. Cast and cure at least three 6-inch by 12-inch (150 mm by 300 mm) cylinders or four 4-inch by 8-inch (100 mm by 200 mm) cylinders in accordance with ASTM C 31/C 31M.

   [*Note: Adjust number of cylinders to be cast if strength tests at other than standard ages are required*]
8. Record the fresh concrete data for each set. The datasheet shall include the following:
   a. Mixture number
   b. Specified 28-day strength
   c. Date and time of batching

d. Time of testing
e. Location of placement
f. Truck number
g. Ticket number
h. Slump, air content, density (unit weight) and temperature of concrete
i. Ambient temperature
j. Names and quantities of admixtures added on site, and, name and title of the person who authorized the addition
k. Set number, if more than one set of cylinders are cast on a single day
l. Name of the testing agency
m. Name and signature of the inspector who conducted the test, and
n. Any additional observations or comments.

9. Mark the cylinders and write the date of casting on each cylinder.
10. Store and protect the cylinders at the job site immediately after casting in accordance with ASTM C 31/C 31M.
11. Transport the cylinders from job site to the laboratory in accordance with ASTM C 31/C 31M after the cylinders have attained acceptable strength.
12. Cure the cylinders in the laboratory in accordance with ASTM C 31/C 31M.
13. Test cylinders for compressive strength in accordance with ASTM C 39/C 39M.
    a. Test one cylinder at 7 days for information and at least two cylinders at 28 days for acceptance when testing 6-inch by 12-inch (150 mm by 300 mm) cylinders, unless otherwise specified.
    b. Test one cylinder at 7 days for information and at least three cylinders at 28 days for acceptance when testing 4-inch by 8-inch (100 mm by 200 mm) cylinders, unless otherwise specified.

    [*Note: Tests at other ages may be specified as necessary.*]
14. Base strength value on the average of at least two 6-inch by 12-inch (150 mm by 300 mm) cylinders or at least three 4-inch by 8-inch (100 mm by 200 mm) cylinders tested at 28 days.
15. Test report shall include the information in Item 8 above and compressive strength test data, and shall be signed by the laboratory manager.
16. Strength of concrete shall be deemed satisfactory if both of the following requirements are met:
    a. Every arithmetic average of any three consecutive compressive strength tests equals or exceeds the specified compressive strength;
    b. No compressive strength test falls below the specified compressive strength by more than 500 psi (3.5 MPa) when the specified strength is 5000 psi (35 MPa) or less; or by more than 10 percent of specified strength, when the specified strength is above 5000 psi (35 MPa).

    If any strength test of laboratory-cured cylinders falls below the specified compressive strength by more than the values specified above, remedial measures shall be taken as recommended by the Architect/Engineer.

3.8 CONSOLIDATION

A. Concrete shall be thoroughly consolidated immediately after deposition in accordance with ACI 301 (ACI 301M).

B. Concrete shall be thoroughly worked around the reinforcing steel, around embedded items and into corners of forms. Use extra care to vibrate in areas requiring more effective consolidation, such as areas with congested reinforcing steel.

3.9 FINISHING

A. See Section 03 35 00 - Concrete Finishing

3.10 CURING AND PROTECTION

A. See Section 03 39 00 - Concrete Curing

3.11 CONSTRUCTION JOINTS

A. Locate joints where indicated on the Drawings or as approved by the Architect/Engineer.

3.12 PATCHING

A. Defective Concrete: Repair defective areas as specified by the Architect/Engineer. Remove and replace concrete that cannot be repaired.

B. See Section 03 01 30 - Maintenance of Cast-in-Place Concrete [Include additional information on patching products in Part 2 and procedures here].

END OF SECTION