Mode: LC
Detector: UV 214 nm
Column: 4.6-mm × 15-cm; 5-µm packing L78
Column temperature: 30°
Flow rate: 1 mL/min
Injection volume: 20 µL
System suitability
Sample: *System suitability solution*
[NOTE—The relative retention times of butabarbital and butalbital are 0.83 and 1.0, respectively.]
Suitability requirements
Resolution: NLT 2.0 between butabarbital and butalbital
Tailing factor: NMT 1.5 for butalbital
Relative standard deviation: NMT 5.0% for butalbital
Analysis
Sample: *Sample solution*
Calculate the percentage of each impurity in the portion of Butalbital taken:

$$\text{Result} = (r_U/r_T) \times 100$$

r_U = peak response of each impurity from the *Sample solution*
r_T = sum of the peak responses from the *Sample solution*

Acceptance criteria
Any individual unspecified impurity: NMT 0.10%
Total impurities: NMT 1%

SPECIFIC TESTS
• **LOSS ON DRYING** ⟨731⟩
Analysis: Dry under vacuum at room temperature to constant weight.
Acceptance criteria: NMT 0.2%

ADDITIONAL REQUIREMENTS
• **PACKAGING AND STORAGE:** Preserve in well-closed containers.
• **USP REFERENCE STANDARDS** ⟨11⟩
USP Butabarbital RS
USP Butalbital RS
USP Salicylic Acid RS

USP Monographs

Butalbital, Acetaminophen, and Caffeine Capsules

» Butalbital, Acetaminophen, and Caffeine Capsules contain not less than 90.0 percent and not more than 110.0 percent of the labeled amounts of butalbital ($C_{11}H_{16}N_2O_3$), acetaminophen ($C_8H_9NO_2$), and caffeine ($C_8H_{10}N_4O_2$).

Packaging and storage—Preserve in tight containers.

USP Reference standards ⟨11⟩—
USP Acetaminophen RS
USP Butalbital RS
USP Caffeine RS

Identification—The retention times of the butalbital, acetaminophen, and caffeine peaks in the chromatogram of the *Assay preparation* correspond to those of the butalbital, acetaminophen, and caffeine peaks in the chromatogram of the *Standard preparation,* as obtained in the *Assay.*

Dissolution ⟨711⟩—
Medium: water; 900 mL.
Apparatus 1: 100 rpm.
Time: 60 minutes.

Mobile phase and *Chromatographic system*—Prepare as directed in the *Assay* under *Butalbital, Acetaminophen, and Caffeine Tablets.*

Standard preparation—Prepare a solution in methanol having known concentrations of about 0.02*A* mg of USP Acetaminophen RS per mL, 0.02*B* mg of USP Butalbital RS per mL, and 0.02C mg of USP Caffeine RS per mL, in which *A, B,* and *C* are the labeled amounts, in mg of acetaminophen, butalbital, and caffeine, respectively, per Capsule. Transfer 5.0 mL of this solution to a 100-mL volumetric flask, dilute with water to volume, and mix.

Procedure—Pass a portion of the solution under test through a filter of 10-µm or finer porosity. Separately inject equal volumes (about 20 µL) of the filtrate and the *Standard preparation* into the chromatograph, record the chromatograms, and measure the responses for the major peaks. Calculate the quantities, in mg, of butalbital ($C_{11}H_{16}N_2O_3$), acetaminophen ($C_8H_9NO_2$), and caffeine ($C_8H_{10}N_4O_2$) dissolved by the same formula:

$$900C(r_U / r_S)$$

in which C is the concentration, in mg per mL, of the appropriate USP Reference Standard in the *Standard preparation;* and r_U and r_S are the peak responses of the corresponding analyte obtained from the solution under test and the *Standard preparation,* respectively.

Tolerances—Not less than 80% *(Q)* of the labeled amounts of $C_{11}H_{16}N_2O$, $C_8H_9NO_2$, and $C_8H_{10}N_4O_2$ is dissolved in 60 minutes.

Uniformity of dosage units ⟨905⟩: meet the requirements.

Assay—
Mobile phase, Internal standard solution, Butalbital standard stock solution, Caffeine standard stock solution, Standard preparation, and *Chromatographic system*—Proceed as directed in the *Assay* under *Butalbital, Acetaminophen, and Caffeine Tablets.*

Assay preparation—Remove, as completely as possible, the contents of not fewer than 20 Capsules. Transfer an accurately weighed portion of the powder, equivalent to about the weight of the contents of 1 Capsule, to a 200-mL volumetric flask, add *Internal standard solution* to volume, and mix. Sonicate for 15 minutes, mix, and allow to cool and settle. Transfer 20.0 mL of the clear supernatant to a 50-mL volumetric flask, dilute with water to volume, and mix. Pass a portion of this solution through a filter of 0.5 µm or finer porosity, discarding the first 5 mL of the filtrate. Use the clear filtrate as the *Assay preparation.*

Procedure—Separately inject equal volumes (about 10 µL) of the *Standard preparation* and the *Assay preparation* into the chromatograph, record the chromatograms, and measure the peak responses for the major peaks. Calculate the quantities, in mg, of butalbital ($C_{11}H_{16}N_2O_3$), acetaminophen ($C_8H_9NO_2$), and caffeine ($C_8H_{10}N_4O_2$) in the portion of Capsules taken by the formula:

$$500D(R_U / R_S)$$

in which *D* is the concentration, in mg per mL, of the appropriate USP Reference Standard in the *Standard preparation;* and R_U and R_S are the peak response ratios of the corresponding analyte to phenacetin obtained from the *Assay preparation* and the *Standard preparation,* respectively.