**HEM.SYSMEX.1.0 Complete Blood Count Using the Sysmex-XT Analyzers**

**PRINCIPLE**

The Sysmex XT Series are a quantitative automated hematology analyzers for in vitro diagnostic use determining hematological parameters. Examination of the numerical and/or morphologic findings of the complete blood count are useful in diagnosis of such disease states as anemia’s, leukemia’s, allergic reactions, viral, bacterial, and parasitic infections. The Sysmex XT-Series analyzer directly measures the WBC, RBC, HGB, HCT, PLT, and PLT-O, LYMPH #, MONO #, EO #, and BASO #. The remaining parameters are calculated or derived: MCV, MCH, MCHC, NEUT#, RDW-CV and differential percentages.

The Sysmex XT Series analyzers count and size RBC and PLT size using electronic resistance detection enhanced by hydrodynamic focusing. HCT is measured as the ratio of the total RBC volume to whole blood using cumulative pulse height detection. HGB is converted to SLS-hemoglobin and read photometrically.

WBC count, differential, and reticulocytes are evaluated using flow cytometry with a semiconductor laser exploiting the differences in cell size, complexity and RNA/DNA content. WBC and basophils (BASO) are treated with an acidic lyse that lyses RBC and WBC but not BASO. The remaining WBC nuclei and intact BASO are differentiated by cell size and internal cellular structure. The WBC differential channel classifies LYMPH, MONO, EO and granulocytes by cellular complexity and nucleic acid content. The differential cell placement is then enhanced utilizing Adaptive Cluster Analysis.

**DOCUMENT OWNER**

Manager, St. Vincent Anderson Hospital Based Laboratories

**RELATED DOCUMENTS**

HEM.SMEARS.4.0 Blood Smear Review and Differential

HEM.SMEARS.6.0 Criteria for Review of Blood Smears by a Pathologist (DFREV)

HEM.SYSMEX.9.0 Quality Control Management on the Sysmex XS, XT, and XE Analyzers

HEM.SYSMEX.10.0 Maintenance on the Sysmex XS, XT, XE

**SPECIMEN**

1. Required Specimen
2. Whole blood anticoagulated with K+ EDTA preferred.
3. Sodium Citrate may be used as an alternative when platelet clumping or platelet satellitism is noted on the EDTA specimen. Use Sodium Citrate results only for platelet counts and WBC counts. Multiply instrument PLT and WBC result by 1.1 to correct for anticoagulant dilution. See Data Review section.
4. Specimen Volume Required
5. Optimal draw is a tube drawn to capacity. Minimum volume is a ¼ filled tube. Tubes that are less than ½ full will be checked for erroneous results associated with short draw specimens. For example, but not limited to, clumped platelets or clotted samples due to difficult draws.

EXCEPTION: a 2.5mL EDTA tube filled less than ½ full is unacceptable.

1. A minimum of 1 mL whole blood is required for auto mode analysis.
2. An EDTA micro-container filled above the 250 μL line is adequate for testing in the open mode.
3. Stored Specimen Stability
4. Stored at 2-8°C, EDTA blood samples (4.0 mL, 2.0 mL and microtainers) may be analyzed up to 48 hours for CBC without significant loss of differential stability.
5. Sample stability at room temperature is 48 hours. Samples stored at room temperature may exhibit an increase in MCV after 24 hours, which may be minimized by refrigeration.
6. Allow refrigerated samples to come to room temperature for a minimum of 15 minutes and mix well before analysis.
7. Specimens collected by venipuncture are best when tested within 4 hours of collection due to possible disintegration of platelets.
8. Micro-samples should be tested as soon as possible after collection.
9. WBC differentials are less stable than the hemogram. Differential analysis of WBC’s is best when testing is performed within 12 hours of collection to prevent abnormal distribution of WBC’s caused by weakened WBC membranes.
10. Unacceptable specimens must be redrawn. Examples:
11. Samples containing clots, fibrin strands or platelet clumps. All specimens will be checked visually by the operator for obvious clots prior to sampling.
12. Grossly hemolyzed samples (causes falsely decreased RBC and hematocrit).
13. Samples drawn above an IV.

**REAGENTS**

1. The Sysmex XT analyzers use the following reagents:

|  |  |  |  |
| --- | --- | --- | --- |
| Reagent | Function | Volume per Container | Open Expiration |
| Cellpack (EPK) | Whole blood diluent for use in hematology analyzers | 20 L | 60 days |
| Stromatolyser -4DL (FFD) | Diluent and lyse reagent for the enumeration of LYMPH, MONO, EO, and granulocytes after eliminating RBC stroma | 5L | 60 days |
| Stromatolyser-4DS (FFS) | Used to stain leukocytes in diluted, lysed blood samples for the determination of the 5-part differential including LYMPH, MONO, EO, and granulocytes | 42 mL | 90 days |
| Stromatolyser-FB(FBA) | Diluent and lyse reagent for enumeration of WBC and BASO count | 12 mL | 60 days |
| Ret-Search (II) (RED) | Diluent and dye used for the staining and enumeration of RBC’s, Reticulocytes and Platelets (XT-2000i analyzer only) | 1000 mL | 60 days |
| Sulfolyser (SLS) | RBC lysing reagent that releases the hemoglobin to be measured by SLS hemoglobin method | 1. mL
 | 60 days |

1. All reagents are stored at room temperature and are to be used within the expiration date.
2. Record date received and date opened on container.
3. All reagents are azide free, and intended for in vitro diagnostic use only; do not ingest.
4. Other reagents
	1. *e*-CHECK: Tri-level commercial controls. Store vials at 2-8°C. When properly stored, unused vials are stable to the expiration date on the vial. Once opened, the product is stable for 7 days when promptly refrigerated after each use. Unused material from open vials should be discarded after 7 days. Do not add residual to a new vial. Record open date on each vial upon opening. Once a vial is opened, the new expiration date should be written on the vial.
	2. Sysmex SCS-1000: a secondary whole blood calibrator. Store at 2-8°C. Do not freeze or expose to excessive heat. Unopened and properly stored, SCS-1000 is stable until expiration date stated on the vial. Open vial stability is 4 hours. Calibration is performed by Sysmex field engineers.
	3. CLOROX® bleach (used for Sysmex Cell-clean). A 5% solution of Clorox® bleach is recommended for use in cleaning and shutdown of Sysmex analyzers.

\*\* Note that 5% Clorox® bleach must be prepared from the 8.25% concentration

 commercially available using the following formula:

|  |  |
| --- | --- |
| Formula | (Conc. 1) x (Vol. 1) = (Conc. 2) x (Vol. 2) |
| 8.25% Concentration | (8.25%) x (Vol. 1) = (5.00%) x (100 mL) |
| Solve (Vol. 1) | (Vol. 1) = 0.05 x 100 mL  0.0825 |
| Answer | Vol. 1 – 60.6 mL |
| Conclusion | **V1 = 60.0 mL 8.25% bleach and 39.4 mL of CLRW will make 100 mL of 5% sodium hypochlorite solution** |

1. Once prepared, solution should remain tightly capped when not in use.
2. Diluted bleach should be dated. Expiration is 7 days. Store in the dark.

**SUPPLIES**

1. Supplies
2. Clinical Laboratory Reagent Water (CLRW)
3. Lint-free plastic lined lab wipes
4. Test tubes
5. Plastic squeeze bottle
6. Gauze
7. Wooden applicator stick

**CALIBRATION**

Initial calibration is performed during installation and verified bi-annually during preventative maintenance (PM) by a Field Service Representative. Calibration compensates for any bias inherent to the pneumatic, hydraulic, and electrical system that may affect the accuracy of results. Calibrators traceable to reference methods are used in the calibration of the instrument. WBC differential parameters are calibrated in the factory prior to shipment and verified by the Sysmex Field Service Representative upon installation.

The laboratory must verify calibration every six months or on an “as needed” basis to ensure accuracy of the system. Calibration is also required if one or more of the following occur:

* Critical parts are replaced such as manometers, apertures, or detector circuit boards.
* Controls show a usual trend or are outside the acceptable limits and cannot be corrected by maintenance or troubleshooting.
* When advised by Sysmex Field Service Representative.

Calibration verification may include review and documentation of acceptable performance of all three levels of commercial control, and Xm QC data, proficiency testing results and patient control testing results. The operator may calibrate the following parameters: WBC, RBC, HGB, HCT, and PLT. **Before calibration, ensure the Sysmex XT analyzer is both clean and precise.**

**QUALITY CONTROL**

See HEM.SYSMEX.12.0 Quality Control Management on the Sysmex XS, XT, and XE Analyzers

**PROCEDURE**

1. Sampler Mode with Barcodes (**150 µL aspirated sample volume**). A minimum of 1.0 cc of blood is required in the tube for the sampler mode.
	1. Place specimens in a rack with the barcodes **facing the front of the rack**. Ensure the labels are smooth with no loose edges.
	2. Load up to 5 racks at one time (50 samples). A new rack may be added to the right rack pool at any time.
	3. On the IPU, click on the “**Sampler**” icon. The Sample number dialog box displays.
	4. Click [**SAMPLE START**] and [**OK**].
	5. The Sysmex XT-Series automatically mixes the sample 10 times, aspirates, and analyzes the sample according to the barcode discrete order. Results print as they are completed if auto-output is employed.

***NOTE*:** *If barcodes are not used, the sample number will increment by 1 as each sample is analyzed. Also, the discrete test to be performed must be selected in the Sampler dialog box.*

1. Open Manual Mode (**85 µL aspirated sample volume**).

1. Click the “**Manual**” icon on the IPU.

2. Enter or scan the specimen number (may be done by using barcode wand or

 manually keying up to 15 alpha/numeric characters)

3., Click on the Discrete panel to be performed on the sample

* 1. Click [**OK**]
	2. Mix the patient sample. Uncap the tube using plastic lined gauze.
	3. Place sample under the sample probe.
	4. Press the **Start** switch. Remove the sample when 3 beeps sound and the green Ready LED stops blinking. Patient results print as samples are completed.
	5. When Ready LED is on, repeat steps a-g for each additional samples.
1. Capillary Mode (**85 µL aspirated sample volume**)
	1. Prepare a 1:5 dilution using 50µL whole blood to 200 µL CELLPACK. Click the “**Manual**” icon. Differential results are suppressed in capillary mode because diluting the specimen reduces the reliability of the differential.
	2. Click on the “**Manual**” icon on the IPU.
	3. Enter or scan the specimen number.
	4. Click on the “Capillary” Mode. Only CBC discrete panels are available for capillary specimens.
	5. Click [**OK**]
	6. Place the well-mixed dilution up to the sample probe and press the **Start** switch. Remove the sample when three beep sound and the green Ready LED stops flashing.
	7. The analyzer will calculate and display the results. **Do not** analyze undiluted specimen using Capillary mode.
	8. Results print as tests are completed if auto-output is employed.
	9. Reset the “Capillary” mode to “Manual” mode by following the steps above. Reset the normal default Manual tests or it will stay at the last option of CBC

**DATA REVIEW**

If any of the parameters on a specimen have had a considerable change from their most recent previous results, the Sunquest computer will flag as a failed delta. A considerable change might include the following:

1. WBC count 0-10.5 150% change

WBC count >10.5 50% change

2. Hgb + 3.0 gms/dL

a. If HGB fails delta high from previously lower HGB, check Function IQ, test: BB (Blood Bank) for transfused blood products. Comment – PRB “Patient received blood product” if applicable.

3. MCV + 4.0 fL

a. Check Function IQ, test: BB for transfused blood products. Comment – PRB if applicable.

b. Check for agglutinin or rouleaux on Wright-stained smear.

c. Check for IV fluid contamination by examining plasma for lipemia. Specimen must be recollected if contaminated with IV fluid.

4. 30% change of PLT count

a. Check for clot.

b. Check Function IQ, test: BB for transfused PLT products.

 **NOTE:** Checking Function IQ, test: BB (Blood Bank) for transfused blood products refers only to testing personnel at HBLs. Checking specimen integrity, labeling and patient identification is sufficient.

These are only suggested guidelines to use since it is up to the technologist’s discretion to check any parameter that changes or that doesn’t appear to be a feasible result for that specimen or patient.

Any specimen suspected for inaccurate results due to a flagged delta, abnormal instrument histogram or flag, or noncorrelating results should be checked for clots by visual inspection and with applicator sticks.

PERFORM A MANUAL DIFFERENTIAL FOR THE FOLLOWING SITUATION

1. Patients under 3 months of age.
2. WBC Suspect flags.

 NRBC?, Blasts?, Immature Grans?, IG Present, WBC ABN Scattergram, Abn

 Lympho/Blasts?

1. WBC <1.0 x 103 µL, regardless of flags.
2. WBC > 45.0 x 103 µL, regardless of flags.
3. %EOS >25
4. %BASO >4
5. Absolute LYMPH >9.0 x 103 µL in children and >6.0 x 103 µL in adults.
6. Absolute MONO >10x 103 µL
7. For MACL specimens or specimens approaching 24 hours old, hold the differential to scan. See HEM.SMEARS.4.0

 REVIEW A WRIGHT-STAINED SLIDE FOR THE FOLLOWING SITUATIONS.

 1. RBC Fragments

 2. MCV <70 with RBC ≥ 5.0 with no previous history

 3. MCV >110 with no previous history

 4. RDW >22.0 with no previous history

 5. Left Shift?

 6. Atypical Lymphocyte: **Scan**. If atypicals present, do DIFF.

 7. Platelet flags:

* Platelet >800 or < 30 x 109 µL with no previous history
* PLT Abn Distribution—if PLT is <150, review the slide to confirm the platelet slide estimate is in agreement with the instrument result, type “**HIDE**” for the MPV result if the instrument was unable to calculate a result.
* \* on Platelets
* PLT Clumps: only scan slide if result is less than the reference range
1. All specimens that are ordered with a differential should be sent for a pathologist review if any

 of the results meet the defined criteria (see HEM.SMEARS.6.0). If a pathologist review has been

 ordered by a physician, the specimen must have had a differential ordered and performed on it

 in order to be sent to the pathologist for review.

1. If for any reason a slide is made on a sample that does not have a differential ordered and upon reviewing the slide, abnormalities are noted which meet the criteria for review, the slide should be sent for a pathologist review. The technologist should record on the report the reason, or criteria, that prompted the pathologist review to be ordered.
2. If you do not get a RDW result due to RBC ABN Distribution, **HIDE** it.
3. Turbidity/HGB Interference: SPIN SPECIMEN
	1. If hemolyzed, recollect specimen
	2. If lipemic, perform dilution or plasma replacement
4. Action Displays and Flagging – **RERUN PROMPTS**

1. If further action is necessary for analyzing a specimen, a message stating **Positive** will appear

 in the upper left corner of the display as well as on the printout.

2. Extremely elevated WBC's may cause turbidity and increase the hemoglobin. It may be

 necessary to dilute the specimen 1:5 with Cellpack and analyze the diluted sample using the

 capillary mode.

* + - 1. If making a 1:5 dilution of patient specimen and NOT running in the capillary mode, multiply measured parameters by 5; recalculate indices.
			2. If correcting the HGB and HCT due to interfering substances recalculate and correct the affected indices:

 MCHC = HGB/HCT x 100

 MCH = HGB/RBC x 10

 MCV = HCT/RBC x 10

 3. A variety of flags can appear on the print out and on the main or graph tab contents. The

 operator must dilute or use other means of resolving the sampling problem. Flags include:

@ Data is outside linearity limits

\* Data is unreliable and may affect results

---- Analysis cannot be performed

++++ Data exceeds analyzer’s reportable range

4. Platelet clumping or satellistism

a. If platelet clumping is determined to be the problem, vortex the sample for 1-2

 minutes at high speed. Rerun the sample and make a new slide. If the platelet

 clumps have disaggregated and the slide review agrees, then the count can be

 reported from the vortexed sample along with the MPV. An estimate of the WBC

 count should also be performed from the vortexed sample, since the platelet clumps

 could have falsely elevated the WBC count in the nonvortexed sample.

 b. If vortexing does not disaggregate clumps, an estimate of platelet concentration

 must be made from the blood smear.

* + 1. If platelets appear adequate, i.e., within or above the normal range, result

 platelet with text code **PAQ** – “Platelets clumped in EDTA but appear adequate

 on smear. Recollect in citrate for accurate count.”

* + 1. If platelets appear decreased, i.e., below the normal range, result platelet with

 text code **PAD** – “Platelets appear decreased on smear but clumped in EDTA.

 Recollect in citrate for accurate count.” Call report to floor or doctor’s office.

* + 1. If platelets appear increased, i.e., near or above critical value, result platelet count with text code **PAI** – “Platelets appear increased on smear by clumped in EDTA. Recollect in Sodium Citrate for accurate count. Call report to floor or doctor’s office.
		2. Report MPV with **UNCAL** “Unable to calculate”

 c. Platelet satellitism is a condition of the platelets encircling the peripheral borders of

 the neutrophils. Satellitism is due to a plasma factor which reacts in the presence of

 EDTA. Follow step c above. If unable to obtain a sodium citrate specimen, incubate

 the blood at 37˚C for 30 minutes to obtain accurate WBC count. Verify that the

 platelets have dissociated from WBCs on a slide of pre-warmed blood before

 resulting WBC. Result PLT with text code **PLSAT** – “Platelet satellitism in EDTA, but

 count appears adequate on smear. Recollect in citrate for accurate count.” Result

 MPV with **UNCAL**.

 d. Upon receipt of Sodium Citrate tube:

i. Run sodium citrate specimen on the Sysmex. Multiply results of platelet and

 WBC count by 1.1 to correct for the dilutional effect of the anticoagulant. Check

 counts by examining a Wright-stained smear.

* + 1. If clumping problem is resolved, enter calculated WBC and PLT result with

 comment – **CITR** – “Test performed on citrate specimen”

 iii. RBC, Hgb, Hct, MCV, RDW, and RBC indices are reported from the EDTA tube.

 iv. The MPV is reported directly from the Sysmex reading on the Sodium Citrate

 specimen (no multiplication required).

 v. If clumping is present on the sodium citrate smear, notify doctor’s office or

 floor of need for recollection using a finger stick for the manual platelet

 method. Send manual platelet fingerstick collection to Regional Hematology

 Laboratory.

**VIEWING/PRINTING ANALYZER RESULTS**

1. Confirm that GP and HC are check-marked and all boxes are marked “output” in the auto-report under the settings. If these are not selected, the analyzer will not communicate with the host and the printer.
2. To view results, select Explorer from the analyzer main screen.
3. To find a recently assayed specimen, highlight the desired sample and double click anywhere in the highlighted area.
4. To find a patient sample by accession number:
5. On tool bar click Edit
6. Click Find
7. Enter sample number or patient ID in pop up box.
8. Click Next. If specimen not found click Previous.
9. Specimen will be highlighted in list. To view graph either double click in highlighted area or click browser.
10. To retransmit data to host:
11. Find specimen in explorer list.
12. On tool bar click Report.
13. Click on Host (HC).
14. To reprint a report:
15. Find specimen in explorer list.
16. On toolbar click on Report.
17. Click on Report (GP).
18. To view graphs of each specimen, select Browser. Use the down arrow to scroll through samples that have been run recently. Highlight and double-click to select the desired sample.

**ENTERING SAMPLES INTO THE SYSMEX COMPUTER**

1. Samples will be automatically uploaded into the Sysmex computer once samples have been received in Sunquest function CVIS. The analyzer will perform the testing associated with that accession number.
2. The analyzer may prompt to rerun a sample, or the operator may decide that a rerun of a sample is indicated. In these cases, it is necessary to manually enter the sample identification and required tests into the system.
3. Select Worklist
4. Type in sample accession number
5. Select test(s)
6. Type in patient medical record number
7. Confirm patient information
8. Click Save

**CALCULATIONS**

HCT = RBC X MCV MCH = HGB X 10 MCHC = HGB X 1000

 10 RBC RBC X MCV

**REPORTING RESULTS**

1. Reference Ranges:

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Parameter** | **Sex** | **1-14 days** | **15-30 days** | **31-60 days** | **61-180 days** | **.5-2 yr** | **2-10 yr** | **10-18 yr** | **>18 yr** |
| **WBC****(K/cu.mm)** | Male | 8.6-14.9 | 7.4-13.3 | 6.0-13.7 | 6.6-15.6 | 6.3-15.4 | 4.0-12.0 | 3.2-11.0 | 3.3-10.5 |
| Female | 8.3-17.6 | 6.9-15.0 | 6.1-13.8 | 6.8-16.2 | 6.4-15.5 | 4.0-12.0 | 3.2-11.0 | 3.2-11.0 |
| **RBC****(mil/cu.mm)** | Male | 3.8-5.3 | 3.0-5.0 | 2.9-3.8 | 3.5-4.8 | 4.1-6.0 | 4.00-5.30 | 3.90-5.60 | 4.15-5.75 |
| Female | 3.9-5.2 | 2.3-4.4 | 2.3-4.4 | 3.6-4.7 | 4.0-5.0 | 4.00-5.30 | 3.90-5.30 | 3.80-5.20 |
| **Hgb (g/dL)** | Male | 12.2-19.9 | 9.1-16.9 | 8.7-12.7 | 9.7-13.3 | 10.3-13.1 | 11.5-14.5 | 11.1-16.1 | 12.8-16.9 |
| Female | 13.6-18.8 | 10.5-15.6 | 9.4-13.5 | 9.9-13.1 | 10.4-13.2 | 11.5-14.5 | 11.1-15.0 | 11.6-15.2 |
| **Hct (%)** | Male | 36.2-58.5 | 26.7-50.3 | 25.2-37.1 | 28.2-39.7 | 30.8-39.1 | 33.0-43.0 | 32.9-46.7 | 38.8-50.2 |
| Female | 39.1-58.5 | 31.8-46.9 | 27.2-41.6 | 28.8-39.5 | 30.7-39.3 | 33.0-43.0 | 32.9-46.7 | 34.4-45.6 |
| **MCV (FL)** | Male | 95.9-100.9 | 80.3-100.1 | 83.9-91.8 | 71.8-85.1 | 69.5-79.7 | 76.0-90.0 | 78.0-95.0 | 78.0-100.0 |
| Female | 98.0-104.2 | 88.9-98.4 | 82.9-93.8 | 73.8-85.8 | 70.9-80.1 | 76.0-90.0 | 78.0-95.0 | 78.0-100.0 |
| **MCH (PG)** | Male | 32.2-35.3 | 30.0-33.7 | 28.6-31.8 | 24.2-29.0 | 23.2-27.3 | 25.0-31.0 | 26.0-32.0 | 27.0-34.0 |
| Female | 32.4-36.5 | 29.7-34.4 | 28.6-32.2 | 24.8-29.2 | 23.4-27.4 | 25.0-31.0 | 26.0-32.0 | 27.0-34.0 |
| **MCHC (g/dL)** | Male | 32.8-35.3 | 33.0-35.3 | 33.0-35.8 | 32.6-35.3 | 32.4-35.0 | 32.0-36.0 | 32.0-36.0 | 32.0-36.0 |
| Female | 32.9-34.4 | 33.3-35.1 | 33.4-35.5 | 32.6-35.4 | 32.4-34.9 | 32.0-36.0 | 32.0-36.0 | 32.0-36.0 |
| **RDW (%)** | Male | 15.2-18.0 | 14.5-18.5 | 13.8-16.3 | 12.2-15.0 | 12.7-15.0 | 11.5-15.0 | 11.5-14.0 | 11.5-15.0 |
| Female | 15.3-16.6 | 14.2-17.0 | 14.0-16.4 | 12.1-14.5 | 12.6-14.7 | 11.5-15.0 | 11.5-14.0 | 11.5-15.0 |
| **PLT (K/cu.mm)** | Male | 249-481 | 253-493 | 269-591 | 307-619 | 229-494 | 150-450 | 150-450 | 150-450 |
| Female | 236-441 | 315-506 | 320-608 | 304-574 | 238-497 | 150-450 | 150-450 | 150-450 |
| **MPV (FL)** | Male | 7.3-11.5 | 7.3-11.5 | 7.3-11.5 | 7.3-11.5 | 7.3-11.5 | 7.3-11.5 | 7.5-11.9 | 7.7-12.2 |
| Female | 7.3-11.5 | 7.3-11.5 | 7.3-11.5 | 7.3-11.5 | 7.3-11.5 | 7.3-11.5 | 7.5-11.9 | 7.7-12.2 |

1. Sysmex linearities:
	1. WBC: 0.10 – 400 x 103 µL
	2. RBC: 0 – 8.00 x 106 µL
	3. HGB: 0 – 25.0 g/dL
	4. HCT: 0 – 60.0%
	5. PLT: 1 – 5000 x 109 µL
2. Critical Values:

HCT, adult < 18%

HCT, newborn < 28%

HGB, adult < 6 g/dL

 PLT (> 12 years old) < 20 x 109 µL, > 999

PLT (≤ 12 years old) < 50 x 109 µL, > 999

WBC > 74.9 x 103 µL

SEGSA <0.4k/mm3 absolute neutrophils

1. Reportable Range

Parameters that exceed the limits listed below are flagged with @ beside the result. The sample must be diluted 1:5 with Cellpack and rerun using the capillary mode.

* 1. WBC >400x103/uL
	2. RBC >8.0x106/uL
	3. HGB >25.0 g/dL
	4. HCT >60.0%

5 PLT >5000x103/uL

**ONLINE ENTRY**

1 Function: OEM, <cr>

2 Tech: <cr>

3 Shift: <cr>

4 Device: Site method Code, <cr>; Test 1: <cr>

5 Workload Data For: <cr>

6 Start at Cup: **Enter number or enter, <cr>**

7 Cursor will appear below accession number assigned to the cup number. Check to see that

 these numbers are correct. <cr>

8 Accept (A), Modify (M), Prelim (P), or Reject (R):

 A: If results are acceptable and there are no messages to attach to report enter:

**A, <cr>**

 M: If there are messages to attach to the report type **M-WBC, <cr>**. The WBC will

 appear on the screen. Enter “-“ then English text codes if indicated, or “-;” to

add free text comments. Also select “M” to modify results if a dilution, saline

replacement, etc. has been performed and these results need to be entered in

 place of the original results.

 R: Reject

 9 If the order included a differential, the automated differential results will then be displayed

 with the prompt FILE (Y/H/N)?

*Note:* Type (Y) to accept the automated differential or (N) to reject. Use the (H) HOLD whenever the automated differential is acceptable, but manual slide needs to be reviewed for RBC morphology.

**PROCEDURE NOTES**

1. Megakaryocytes: when megakaryocytes are present, perform a WBC and PLT estimate.
2. Capillary Analysis
	* + 1. Use when insufficient patient sample is available for aspiration in the open mode (<85 µL) or a sample has a parameter above the linearity limits of the analyzer.
			2. Because of the dilution factor, the reliability of the differential is reduced; therefore, only a CBC or CBC + RETIC (Sysmex XT-2000i analyzer only) discrete panels can be selected.
			3. If there are marked changes in plasma constituents (i.e. very low sodium or very high glucose), prepare a 1:5 dilution to allow to equilibrate before analysis.
3. Analysis of the specimen on Sysmex XT-1800i Series is recommended before removing the cap to make smear.
4. **Do not** place samples on a mechanical rocker. Excessive mixing may induce platelet clumping

**LIMITATIONS**

* 1. Reject clotted samples or those containing clots, fibrin strands, or platelet clumps. All specimens will be checked visually by the operator for obvious clots prior to sampling on the analyzer. Reject all clotted specimens.
	2. Severely hemolyzed samples (in vitro) falsely decrease RBC and hematocrit. Recollect grossly hemolyzed specimens.
	3. Do not place samples on a mechanical rocker. Constant rocking may cause PLT clumping and alter white cell membranes resulting in false flagging messages.
	4. Cold agglutinins produce spurious macrocytosis, elevated MCH's, MCHC's, falsely decreased RBC counts and HCT's. Warm the specimen at 37°C for minimum of 15 minutes and rerun. Some specimens may require up to one hour incubation due to a high level of red cell agglutination.
	5. Giant platelets and clumped platelets may falsely elevate the WBC count and falsely decrease the platelet count.
	6. Abnormal paraproteins found in Multiple Myeloma patients can falsely increase the HGB and on rare occasions the WBC and PLT parameters can be affected. To correct HGB perform saline replacement using Sysmex Cellpack.
	7. Lipemia falsely elevates the HGB and MCHC. Perform a plasma replacement by making 1:5 dilution with CELLPACK.
	8. Severely icteric samples falsely elevate the HGB value and related indices. Make a 1:5 dilution with CELLPACK.
	9. Possible Additional Sample Interferences:
1. WBC – Where the following are present, the white blood cell count may be reported falsely high: red blood cells resistant to hemolysis; cold agglutinins; platelet aggregation; nucleated RBCs; cryoglobulin.
2. RBC – Where the following are present, the red blood cell count may be reported falsely low: cold agglutinins; microcytosis; fragmented erythrocytes. The red blood cell count may be reported falsely low in the presence of leukocytosis (more than 100,000/µL.)
3. HGB – Where the following are present, the hemoglobin may be reported falsely high: leukocytosis (more than 100,000/µL); lipemia; bilirubin.
4. HCT – Where the following are present, the hematocrit value may be reported falsely low: cold agglutinins; fragmented erythrocytes. Where the following are present, the hematocrit value may be reported falsely high: leukocytosis (more than 100,000/µL); severe diabetes; uremia.
5. PLT – Where the following are present, the platelet count may be reported falsely low: pseudo platelet attrition; platelet aggregation; megalocytic platelets. Where the following are present, the platelet count may be reported falsely high: micro erythrocytes; red cell fragments; WBC fragments; cold albumin.

J. Marked changes in plasma constituents (e.g. low sodium, extremely elevated glucose) may cause

 cells to swell or shrink. The blood to anticoagulant ration is important.

K. Mixing specimen excessively may affect the WBC differential.

**REFERENCES**

1. Sysmex XT-2000*i*/XT-1800*i* CLSI Procedure, Sysmex Corporation, January 2014.
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4. Cornbleet, J., Spurious results from automated hematology cell counters. Laboratory Medicine. 1983; 8:509-514.