

## The Federal Reserve System

### INTEREST ON REQUIRED RESERVE BALANCES AND EXCESS BALANCES

#### *How to Calculate Required Reserve Balances and Excess Balances*

As of October 1, 2008, the Federal Reserve has the authority to pay interest on balances maintained at Reserve Banks. The following examples illustrate how required reserve balances and excess balances will be determined for a variety of account types. These balances will be used in conjunction with the interest rates for required reserve balances and excess balances to calculate the amount of interest owed to an institution fifteen days after the end of a reserve maintenance period.

The formula for calculating interest payments is:

$$\text{Interest} = \text{balance} * \left[ \left( \frac{\text{rate}}{100} \right) * \left( \frac{n}{360} \right) \right],$$

where *balance* is either the required reserve balance or the excess balance maintained during a reserve maintenance period, *rate* is the interest rate in percentage points established by the Board of Governors, and *n* is the number of days in an institution's reserve maintenance period (seven days or fourteen days).

On December 16, 2008, the Board of Governors amended its rules governing the payment of interest so that the interest rates on required reserve balances and on excess balances would be equal to 25 basis points, effective with the reserve maintenance periods beginning December 18, 2008. The Board of Governors will continue to evaluate the appropriate settings of the rates paid on balances in light of evolving market conditions and make adjustments as needed.

**Example A: Institution that Satisfies its Reserve Requirement Fully with Vault Cash without a Contractual Clearing Balance**

*Reserve Maintenance Period Averages in Thousands of Dollars*

a.	Reserve Requirement	500
b.	Vault Cash	500
c.	Reserve Balance Requirement (a-b)	0
d.	Contractual Clearing Balance	0
e.	Total Balance Requirement (c+d)	0
f.	Maintained Balance	125
g.	Gross Position (f-e)	125
h.	Carry-in	0
i.	Clearing Balance Allowance	0
j.	Net Excess or Deficiency Adjusted for Clearing Balance Allowance (g-i)	125
k.	Maximum Allowable Carry-over (in absolute value)	50
l.	Carry-out	50
m.	Carry-out offset in the next reserve maintenance period	0
n.	Final Position (j-m)	125
o.	Earnings Credit Base	0
p.	Required Reserve Balance	0
q.	Excess Balance	125

**Example A**

*Calculation of gross position:* The institution's vault cash of \$500,000 (line b) completely satisfies its reserve requirement of \$500,000. Therefore, the institution does not have a reserve balance requirement (line c). The institution does not have a contractual clearing balance. As a result, the institution's total balance requirement is zero. The average end-of-day balance over the reserve maintenance period of \$125,000 (line f) represents a gross excess position of \$125,000 (line g).

*Calculation of maximum allowable carry-over and final position:* Maximum allowable carry-over is calculated as either \$50,000 or 4 percent of the institution's total balance requirement (line e), whichever is greater, less the clearing balance allowance (line i). The maximum allowable carry-over for this institution is \$50,000 (line k). The institution did not offset the \$50,000 carried out from the current reserve maintenance

period (line l) in the next reserve maintenance period. Therefore, final position (line n) is an excess of \$125,000.

*Calculation of required reserve and excess balances on which interest will be paid in the current reserve maintenance period:* Because the institution does not have a reserve balance requirement (line c), its required reserve balance is zero (line p). The institution has an excess balance of \$125,000 (line q). The excess balance is calculated as the amount of balances maintained in excess of the institution's reserve balance requirement, adjusted for carry-out offset in the next reserve maintenance period. Because none of the \$50,000 eligible for carry-out is offset in the next reserve maintenance period, it is included in the current reserve maintenance period's excess balance.

**Example B: Institution that Satisfies its Reserve Requirement Fully with Vault Cash with a Contractual Clearing Balance**

*Reserve Maintenance Period Averages in Thousands of Dollars*

a.	Reserve Requirement	500
b.	Vault Cash	500
c.	Reserve Balance Requirement (a-b)	0
d.	Contractual Clearing Balance	40
e.	Total Balance Requirement (c+d)	40
f.	Maintained Balance	125
g.	Gross Position (f-e)	85
h.	Carry-in	0
i.	Clearing Balance Allowance	25
j.	Net Excess or Deficiency Adjusted for Clearing Balance Allowance (g-i)	60
k.	Maximum Allowable Carry-over (in absolute value)	0
l.	Carry-out	0
m.	Carry-out offset in the next reserve maintenance period	0
n.	Final Position (j-m)	60
o.	Earnings Credit Base	65
p.	Required Reserve Balance	0
q.	Excess Balance	60

**Example B**

*Calculation of gross position:* The institution's vault cash of \$500,000 (line b) completely satisfies its reserve requirement of \$500,000. Therefore, the institution does not have a reserve balance requirement. The institution has a contractual clearing balance of \$40,000. The average end-of-day balance over the reserve maintenance period of \$125,000 (line f) exceeds the total balance requirement of \$40,000 (line e), leaving the institution with a gross excess position of \$85,000 (line g).

*Calculation and application of the clearing balance allowance:* The clearing balance allowance is equal to the greater of \$25,000 or 2 percent of the contractual clearing balance. The clearing balance allowance (line i) for this institution is \$25,000. Application of the clearing balance allowance reduces the excess position to \$60,000 (line j).

*Calculation and application of the maximum allowable carry-over, carry-out, and final position:* The institution has a contractual clearing balance but does not have a reserve balance requirement. Therefore, the institution is not eligible for the reserve carry-over privilege. It can only take advantage of the flexibility provided by the clearing balance allowance. The final position (line n) is an excess of \$60,000.

*Calculation of earnings credits base:* Earnings credits are based on \$65,000. This base amount is calculated as the contractual clearing balance of \$40,000 (line d) plus the balance applied to the \$25,000 clearing balance allowance (line i).

*Calculation of required reserve and excess balances on which interest will be paid in the current reserve maintenance period:* Because the institution does not have a reserve balance requirement, the required reserve balance is zero (line p). The institution's excess balance is \$60,000 (line q). The excess balance is calculated as the amount of balances maintained in excess of the institution's total balance requirement and clearing balance allowance.

**Example C: Institution with Vault Cash less than its Reserve Requirement  
without a Contractual Clearing Balance**

*Reserve Maintenance Period Averages in Thousands of Dollars*

a.	Reserve Requirement	500
b.	Vault Cash	400
c.	Reserve Balance Requirement (a-b)	100
d.	Contractual Clearing Balance	0
e.	Total Balance Requirement (c+d)	100
f.	Maintained Balance	225
g.	Gross Position (f-e)	125
h.	Carry-in	0
i.	Clearing Balance Allowance	0
j.	Net Excess or Deficiency Adjusted for Clearing Balance Allowance (g-i)	125
k.	Maximum Allowable Carry-over (in absolute value)	50
l.	Carry-out	50
m.	Carry-out offset in the next reserve maintenance period	50
n.	Final Position (j-m)	75
o.	Earnings Credit Base	0
p.	Required Reserve Balance	100
q.	Excess Balance	75

**Example C**

*Calculation of gross position:* The average end-of-day balance over the reserve maintenance period of \$225,000 (line f) exceeds the total balance requirement of \$100,000 (line e), leaving the institution with a gross excess position of \$125,000 (line g).

*Calculation and application of maximum allowable carry-over, carry-out, and final position:* Maximum allowable carry-over is calculated as either \$50,000 or 4 percent of the institution's total balance requirement (line e), whichever is greater, less the clearing balance allowance. The maximum allowable carry-over for this institution is \$50,000 (line k). After adjusting for the carry-out offset in the next reserve maintenance period of \$50,000 (line m), the final position is an excess of \$75,000.

*Calculation of required reserve and excess balances on which interest will be paid in the current reserve maintenance period:* The institution's required reserve balance is \$100,000 (line p). The required reserve balance is calculated as the balances maintained to meet the institution's reserve balance requirement. The institution's excess balance is \$75,000 (line q). The excess balance is calculated as the amount of balances maintained in excess of the institution's total balance requirement, adjusted for carry-out offset in the next reserve maintenance period. Because the \$50,000 eligible for carry-out is offset in the next reserve maintenance period (line m), it is not included in the current reserve maintenance period's excess balance. Rather, the \$50,000 of carry-out offset (line m) will be taken into consideration when calculating the next reserve maintenance period's required reserve balance and earnings credits base.

**Example D: Institution with Vault Cash less than its Reserve Requirement with a Contractual Clearing Balance**

*Reserve Maintenance Period Averages in Thousands of Dollars*

a.	Reserve Requirement	500
b.	Vault Cash	400
c.	Reserve Balance Requirement (a-b)	100
d.	Contractual Clearing Balance	40
e.	Total Balance Requirement (c+d)	140
f.	Maintained Balance	200
g.	Gross Position (f-e)	60
h.	Carry-in	0
i.	Clearing Balance Allowance	25
j.	Net Excess or Deficiency Adjusted for Clearing Balance Allowance (g-i)	35
k.	Maximum Allowable Carry-over (in absolute value)	25
l.	Carry-out	25
m.	Carry-out offset in the next reserve maintenance period	25
n.	Final Position (j-m)	10
o.	Earnings Credit Base	65
p.	Required Reserve Balance	100
q.	Excess Balance	10

**Example D**

*Calculation of gross position:* The average end-of-day balance over the reserve maintenance period of \$200,000 (line f) exceeds the total balance requirement of \$140,000 (line e), leaving the institution with a gross excess position of \$60,000 (line g).

*Calculation and application of the clearing balance allowance:* The clearing balance allowance is equal to the greater of \$25,000 or 2 percent of the contractual clearing balance. The clearing balance allowance (line i) for this institution is \$25,000. Application of the clearing balance allowance reduces the excess position to \$35,000 (line j).

*Calculation and application of the maximum allowable carry-over, carry-out, and final position:* The maximum allowable carry-over is calculated as either \$50,000 or 4 percent

of the institution's total balance requirement (line e), whichever is greater, less the clearing balance allowance. The maximum allowable carry-over for this institution is \$25,000 (line k). The net excess position of \$35,000 (line j) exceeds the maximum allowable carry-over, so, only \$25,000 of the excess can be carried out. After adjusting for the carry-out offset in the next reserve maintenance period of \$25,000 (line m), the final position is \$10,000.

*Calculation of earnings credits base:* Earnings credits are based on \$65,000. This base amount is calculated as the \$40,000 contractual clearing balance (line d) plus the balance applied to the \$25,000 clearing balance allowance (line i).

*Calculation of required reserve and excess balances on which interest will be paid in the current reserve maintenance period:* The institution's required reserve balance is \$100,000 (line p). The required reserve balance is calculated as the balances maintained to meet the institution's reserve balance requirement. The institution's excess balance is \$10,000 (line q). The excess balance is calculated as the amount of balances maintained in excess of the institution's total balance requirement and clearing balance allowance, accounting for carry-out (line g less line i less line m). Because the \$25,000 eligible for carry-out is offset in the next reserve maintenance period (line m), it is not included in the current reserve maintenance period's excess balance. Rather, the \$25,000 of carry-out offset (line m) will be taken into consideration when calculating the next reserve maintenance period's required reserve balance and earnings credits base.

<b>Example E: Institution with Vault Cash less than its Reserve Requirement <u>with</u> a Contractual Clearing Balance</b>		
<i>Reserve Maintenance Period Averages in Thousands of Dollars</i>		
a.	Reserve Requirement	500
b.	Vault Cash	400
c.	Reserve Balance Requirement (a-b)	100
d.	Contractual Clearing Balance	40
e.	Total Balance Requirement (c+d)	140
f.	Maintained Balance	100
g.	Gross Position (f-e)	-40
h.	Carry-in	0
i.	Clearing Balance Allowance	-25
j.	Net Excess or Deficiency Adjusted for Clearing Balance Allowance (g-i)	-15
k.	Maximum Allowable Carry-over (in absolute value)	25
l.	Carry-out	-15
m.	Carry-out offset in the next reserve maintenance period	-15
n.	Final Position (j-m)	0
o.	Earnings Credit Base	0
p.	Required Reserve Balance	100
q.	Excess Balance	0

### **Example E**

*Calculation of gross position:* While the average end-of-day balance over the reserve maintenance period of \$100,000 (line f) is sufficient to meet the reserve balance requirement of \$100,000 (line c), it is not sufficient to meet the total balance requirement of \$140,000 (line e). As a result, the institution has a gross deficient position of \$40,000 (line g). The entire deficiency is a clearing balance deficiency.

*Calculation and application of the clearing balance allowance:* The clearing balance allowance is equal to the greater of \$25,000 or 2 percent of the contractual clearing balance. The clearing balance allowance (line i) for this institution is \$25,000. Application of the clearing balance allowance reduces the deficiency to \$15,000 (line j).

*Calculation and application of the maximum allowable carry-over, carry-out, and final position:* The maximum allowable carry-over is calculated as either \$50,000 or 4 percent of the institution's total balance requirement (line e), whichever is greater, less the clearing balance allowance (line i). The maximum allowable carry-over for this institution is \$25,000 (line k). After adjusting for carry-out offset in the next reserve maintenance period of negative \$15,000 (line m), the final position is zero, and the institution is not subject to a clearing balance deficiency charge.

*Calculation of earnings credits base:* No earnings credits are generated because no balance was maintained to satisfy the institution's contractual clearing balance in the current reserve maintenance period. Earnings credits will be accrued in the next reserve maintenance period on the \$15,000 clearing balance deficiency covered in the next reserve maintenance period (line m).

*Calculation of required reserve and excess balances on which interest will be paid in the current reserve maintenance period:* The institution's required reserve balance is \$100,000 (line p). The required reserve balance is calculated as the balances maintained to meet the institution's reserve balance requirement. The institution's excess balance is zero (line q). Because the institution was deficient in its contractual clearing balance, by definition, it did not hold any balances in excess of its reserve balance requirement.

<b>Example F: Institution with Vault Cash less than its Reserve Requirement <u>without</u> a Contractual Clearing Balance</b>		
<i>Reserve Maintenance Period Averages in Thousands of Dollars</i>		
a.	Reserve Requirement	500
b.	Vault Cash	400
c.	Reserve Balance Requirement (a-b)	100
d.	Contractual Clearing Balance	0
e.	Total Balance Requirement (c+d)	100
f.	Maintained Balance	35
g.	Gross Position (f-e)	-65
h.	Carry-in	0
i.	Clearing Balance Allowance	0
j.	Net Excess or Deficiency Adjusted for Clearing Balance Allowance (g-i)	-65
k.	Maximum Allowable Carry-over (in absolute value)	50
l.	Carry-out	-50
m.	Carry-out offset in the next reserve maintenance period	-50
n.	Final Position (j-m)	-15
o.	Earnings Credit Base	0
p.	Required Reserve Balance	35
q.	Excess Balance	0

### **Example F**

*Calculation of gross position:* The average end-of-day balance over the reserve maintenance period of \$35,000 is insufficient to cover the institution's reserve balance requirement of \$100,000 (line c). As a result, the institution has a gross deficient position of \$65,000 (line g).

*Calculation and application of the maximum allowable carry-over, carry-out, and final position:* The maximum allowable carry-over is calculated as either \$50,000 or 4 percent of the institution's total balance requirement (line e), whichever is greater, less the clearing balance allowance (line i). The maximum allowable carry-over for this institution is \$50,000 (line k). After adjusting for carry-out offset in the next reserve maintenance period of negative \$50,000 (line m), the final position is negative \$15,000, the entire amount of which is subject to a reserve balance deficiency charge.

*Calculation of required reserve and excess balances on which interest will be paid in the current reserve maintenance period:* The institution's required reserve balance is \$35,000 (line p). The required reserve balance is calculated as the balances maintained to meet the institution's reserve balance requirement. The institution's excess balance is zero (line q). Because the institution was deficient in its reserve balance requirement, by definition, it did not hold any balances in excess of its reserve balance requirement.

<b>Example G: Institution <u>with</u> ONLY a Contractual Clearing Balance</b>		
<i>Reserve Maintenance Period Averages in Thousands of Dollars</i>		
a.	Reserve Requirement	0
b.	Vault Cash	0
c.	Reserve Balance Requirement (a-b)	0
d.	Contractual Clearing Balance	80
e.	Total Balance Requirement (c+d)	80
f.	Maintained Balance	125
g.	Gross Position (f-e)	45
h.	Carry-in	0
i.	Clearing Balance Allowance	25
j.	Net Excess or Deficiency Adjusted for Clearing Balance Allowance (g-i)	20
k.	Maximum Allowable Carry-over (in absolute value)	0
l.	Carry-out	0
m.	Carry-out offset in the next reserve maintenance period	0
n.	Final Position (j-m)	20
o.	Earnings Credit Base	105
p.	Required Reserve Balance	0
q.	Excess Balance	20

### **Example G**

*Calculation of gross position:* The average end-of-day balance over the reserve maintenance period of \$125,000 (line f) exceeds the contractual clearing balance of \$80,000 (line d). As a result, the institution has a gross excess position of \$45,000 (line g).

*Calculation and application of the clearing balance allowance:* The clearing balance allowance is equal to the greater of \$25,000 or 2 percent of the contractual clearing balance. The clearing balance allowance (line i) for this institution is \$25,000. Application of the clearing balance allowance reduces the excess to \$20,000 (line j).

*Calculation and application of the maximum allowable carry-over, carry-out, and final position:* This institution is not eligible for the reserve carry-over privilege because it does not have a reserve balance requirement. However, it can take advantage of the

flexibility provided by the clearing balance allowance. The final position of \$20,000 (line n) is calculated as the \$45,000 gross position (line g) less the \$25,000 clearing balance allowance (line i).

*Calculation of earnings credits base:* Earnings credits are based on \$105,000. This base amount is calculated as the \$80,000 contractual clearing balance (line d) plus the balance applied to the \$25,000 clearing balance allowance (line i).

*Calculation of required reserve and excess balances on which interest will be paid in the current reserve maintenance period:* Because the institution does not have a reserve balance requirement, its required reserve balance is zero (line p). The institution's excess balance is \$20,000 (line q). The excess balance is calculated as the amount of balances maintained in excess of the institution's contractual clearing balance and clearing balance allowance.