



GST and Rounding Errors

Supply Chain - e-Procurement

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Final

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1 Introduction

1.1 Purpose

GST and rounding errors can be the source of legitimate variances in Purchase Orders and Invoices which may require manual intervention. Since one of the benefits of e-Procurement is to minimise the amount of manual intervention required, this document describes procedures that will allow these variances to be processed as automatically as possible. These variances are usually minimal, and the cost of correcting them is far more than the cost of the variance itself. In some extreme cases though, they have created misunderstandings which have damaged the relationship between buyer and seller.

It should be a minor issue unless adequate preparation has not been made.

1.2 Background

Rounding means reducing the number of digits that represent the number. Computer programs have a limit to the amount of precision at which numbers can be stored, and if this precision is exceeded by a calculation, then rounding occurs to keep it within those limits. (This example is unrelated to procurement, but in 1991 a rounding error in a Patriot missile system led to the death of 28 people. See <http://www.ima.umn.edu/~arnold/disasters/patriot.html> for a very technical discussion of this particular rounding error.)

A rounding error is produced when a calculation result is rounded and produces a different result to the theoretical result. There will always be rounding errors. The problems arise when the buyer and seller systems use different rounding protocols and produce a variance between two theoretically identical documents. For example, assume an item on an order is replenishment of 625 test strips at \$22.58 per hundred, with a 7.5% discount and GST of 10%. If precision is maintained at 8 decimal places throughout the calculations and rounded to the nearest cent at the end, the price calculates to \$143.59. However if each calculation is rounded to the nearest cent, the price calculates to \$143.61.

2 Details

2.1 Rounding Mechanisms

There are multiple ways in which rounding can occur e.g. round nearest, round up, round down, truncate. Round nearest is the most commonly used, but even with this one method, there are several versions all centred on whether the digit 5 should be rounded up or down. There is also a divergence of opinion as to what up or down means when it comes to negative numbers, which could have some influence on discounts.

2.2 GST Calculation Methods

GST can be legally calculated in two ways. It can be calculated on the value of each line in the invoice, and then summed to give the total GST, or the total GST can be calculated on the total value of the invoice. (In both cases, non-GST items are excluded from the calculation.) The difference comes because the line method has rounding error for each line, whereas the total method has only one rounding error.

The following is an example of 10 items on an invoice with the GST calculated using both methods to show the difference.

	<i>Price Ex GST</i>	<i>GST</i>
	320.23	32.02
	234.94	23.49
	22.43	2.24
	564.81	56.48
	54.23	5.42
	432.87	43.29
	842.34	84.23
	55.84	5.58
	112.74	11.27
	99.34	9.93
Total Price ex GST	2739.77	
	GST as 10% of Total Price ex GST.	GST as sum of individually calculated amounts
Total GST	273.98	273.95

2.3 Quantity Rounding Errors

Most items are ordered in units, but some are ordered by volume or lineal measurement. For example, 2.25 litres of Pharmaceutical grade Ethanol, or 1.384 metre of tubing. If the Buyer's system and the Seller's system don't use the same number of decimals, a rounding error can occur.

For example, if the buyers system used 3 decimal points and the sellers system used 2, when the buyer sends an order for 1.384 metres, the buyer would receive it as 1.38 metres.

2.4 Discount/Charges/Proportional Rounding Errors etc.

This is a class of rounding errors relating to calculations made to the value of an item on the invoice. Discounts and Charges (e.g. 5% handling fee) often produce results which are a fraction of a cent. Proportional rounding errors

occur when the cost of the item is expressed as a rate e.g. \$58.42 per 1,000 and 1200 items are ordered: cost = $1.2 \times \$58.42 = \70.104 , rounded to \$70.10

Note: *Individually, these variances are typically small values. However, the sheer volume of variances in an invoice can produce some significant total variances. In particular, if there are several variances in a calculation, the variances do not add together, they compound together to produce an even larger variance. For example, a final price may involve a Handling Fee and a Discount. Individually, the Handling Fee component may have a variance of 1c and the Discount a variance of 1.5c; however the total variance when both are applied could be 3c. The more elements in a calculation, the greater the compounding effect.*

3 Procedure

1. GST will be calculated at line level, not whole invoice level.
2. Dollar amounts will be held to the nearest cent at all times. That is, no invoice prices will have fractions of a cent, and intermediate calculations will be rounded to the nearest cent.
3. Decimal quantities will be limited to 3 decimal places. (Based on practices used in other industries.)
4. Rounding will be the “round nearest” mechanism. If the digit in the first decimal place being truncated is between 0 and 4 inclusive, it will be rounded down. If it is between 5 and 9 inclusive, it will be rounded up.
5. Enable Invoice tolerances in the Accounts Payable system, and set it to a level where it becomes cost-effective to investigate the variances. (Note: It may also be prudent for an accountant to review the accounting transaction entries for these variances at the same time.)
6. If there is a genuine case where these rules do not apply, either put the required information into the “Special Instructions” field or use a manual Purchase Order. For example, if a shaft needed to be exactly 1.2834m, then the order would be for Quantity: 1; Item: “Shaft”; Special Instructions: “Length is 1.2834m”.